POWER

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ELY C. HUTCHINSON, *Editor*

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This Page

Now, after many years, the hundreds, yes thousands, of Fred Low's friends will miss his signature at the bottom of this page. They will miss the forewords which so beautifully expressed a philosophy and personality identified and synonomous with *Power* for more than forty years.

Mr. Low has asked to be relieved of the responsibility of regularly contributing the page to which so many have looked forward each week, and I am sure his friends will join with his fellow workers in agreeing that he has earned the rest and easier life he looks forward to and so greatly deserves.

His place cannot be filled. One can only try to prove worthy of his heritage.

So the editor will use this page for discussion of timely topics of general concern to *Power* readers, although not necessarily related to the strict technical aspects of power production.

To sweeten the dose, the editor hopes to glean a gem from the pen of the editor emeritus now and then, for the page belongs to him whenever the urge to use it becomes greater than the desire for golf and peaceful seclusion with the family at the New Hampshire farm.

EDITORIALS

How Poor Is The Engineer?

THERE has been much talk about the poverty of engineers. With the exception of teaching and the ministry, no profession, it has been repeatedly claimed, is so poorly paid for its contributions.

It now appears, however, that typical engineering earnings, while moderate, are somewhat higher than had been thought. An authentic source of information is now available in the shape of a report issued by the A.S.M.E. committee appointed to investigate the economic status of the mechanical engineer. An abstract of this report, including all charted data, appears in this number.

The figures presented are based on the actual answers of more than 50 per cent of the A.S.M.E. membership. As the method of gathering information insured absolute privacy for individual data, there was no reason to exaggerate earnings for the sake of appearances. Finally, the committee, taking a leaf from the book of modern statisticians, uses *median* earnings (earnings of the typical man) throughout rather than average earnings. This typical man falls half way up the line of wealth. Half of the group earns less than he and half earns more. Incidentally, the median salaries reported run consistently less than the corresponding averages.

The typical engineer in the United States (or, more precisely, the typical A.S.M.E. member) for 1930 has a maximum salary of $7,500 between the ages of 53 and 57. The lower boundary of the upper 25 per cent has a maximum salary of $12,500. It appears that salaries for the profession as a whole are reasonably satisfactory, although probably less than in certain other professions.

Study of median earnings by geographical areas reveals some interesting facts. Earnings in the metropolitan district (New York City and environs) run much higher at all ages, but it is pointed out that the excess barely takes care of the higher cost of living in that section. On the other hand, median earnings in the Southern, Prairie and Mountain, and Pacific districts fall off sharply from the national median as the age of 50 is approached. For the age of 52 the median salaries in these regions averages about $2,000 lower.

Aside from the general features already pointed out, one conclusion stands out particularly in this report. It is the great reward open to those engineers who add managerial abilities and functions to those strictly technical.

The A.S.M.E. has done well to apply engineering methods to this much-mooted question of engineers' earnings. Digging up the facts is the first step always.

Water-Measurement Methods

IT IS not so long ago that the most reliable, universally used method for water measurement was the weir, and practically all efficiency tests for reaction turbines and impulse wheels were conducted with some form of weir for measuring the water quantity. The sizes of weirs grew in conformity with the increase of horsepower capacity in the hydraulic prime movers, and with the increase of the weir dimensions came inaccuracies and influences affecting the water flow which rapidly discredited large-sized weirs as a precision method for measuring large water volumes.

In fact, the objectionable features and the desirability of having some more accurate method of water measurement were appreciated well in advance of the period when the weaknesses in weir measurement methods caused loss of confidence in their use for efficiency tests.

Then, contemporaneously, several modern methods of water measurement appeared on the horizon. Of these, the two most generally used in America are the Allen salt-velocity method and the Gibson pressure-time method. Continental Europe has pinned its faith mostly to current meters. All three methods have developed greatly in the past few years and, when used under the conditions properly suited to them and in the hands of experts experienced in their technique, they compare favorably and will produce similar result with remarkably little difference. But when the accuracy of the three methods is competitively tested by one who is expert in one of the methods only, an erroneous impression and an unsatisfactory, and perhaps even inaccurate, conclusion are likely.

There are so many pros and cons upon this entire subject that it ill behooves a fair-minded hydraulic engineer to draw conclusions with respect to any of the

methods without complete information upon the details of the test.

Because any of the three methods may be best under certain conditions it does not follow at all that its superiority for all conditions has been proved, nor does it even follow that its accuracy will be as great as that of another method under different conditions. None of the methods should be adopted without making certain in advance, by model tests or otherwise, of its suitability.

In the meantime, records purporting to show comparative tests in methods should be carefully scanned and judged only after full knowledge of the circumstances and conditions. Above all things, it is hoped that nothing will permit nor develop the spirit of competition between the different systems, as this can have only harmful results.

Engineers As Inventors

ONLY ten per cent of the engineers listed in *Who's Who in Engineering* report having made inventions. "This," says Joseph Rossman, patent examiner, "is a rather surprising result, as we should expect these men to make many inventions, since they come into intimate contact with mechanical devices." It *is* rather strange, when one stops to think of it, that so many engineers never invent (or at least never patent). It is equally surprising to see the totally uneducated and ignorant inventor dashing from one new thing to another and, now and then, producing an invention of real worth.

This whole problem was discussed with sympathy and insight by Dr. Rossman in the August number of the *Journal of the Patent Office Society*. He quoted many authorities to show that the engineer's training tends, to some extent, to kill inventive initiative. "There are few engineering schools in this country," says Dr. Rossman, "that encourage original or creative work on the part of their students. No courses are given which tend to stimulate or bring out any originality . . . Most of the time is spent in studying textbooks and authorities, so that by the time the student graduates any originality which he might have had has been completely stifled and suppressed."

This is part truth. There are certainly some engineering teachers in the United States who definitely encourage originality, but they are probably in the minority.

For some strange reason invention and inventors are not properly valued by engineers. Copying is more highly regarded than creative work. One engineer said, in this connection, "The instant the engineer begins to invent things, he loses caste with his profession, because his work is new and cannot, therefore, be based upon past experience and it is, therefore, not good engineering practice. It creates doubt, protest and ridicule to all of which the inventor must be deaf. The inventor approaches his problem from behind; he looks always toward the future into a *terra incognita;* he sails on an uncharted sea as Columbus did. He begins at the end of the world where knowledge and experience end. Beyond him there is no beaten path and no light, no compass, no chart—nothing."

It is perhaps to be expected that only the exceptional engineer should be of value as an inventor. Engineers must be careful, precise, painstaking—qualities which do not easily go with imagination and daring, essential to invention. We cannot spoil our engineers to make inventors. At the same time, it is to be hoped that more and more engineers will train themselves to make fundamental contributions in the form of invention.

When the engineer does bring his imagination to the plane of invention, he has a great advantage over the "natural-born" uneducated inventor in that his trained engineering mind will quickly detect flaws and save him from running wild.

Meter or Waste

ALMOST DAILY new evidence comes to light to strengthen the case for departmental metering. Wherever such meters are installed substantial wastes are discovered, often of the most inexcusable nature.

The latest example that comes to the attention of *Power* is typical. A certain department head received his first bill for power services. Included were substantial quantities of high-pressure steam and compressed air. Immediately this department head objected, because, he said (and honestly believed), he was using neither of these two services. Without much difficulty, however, the power engineer was able to show him that these two services were being used—air for sweeping the floor and washing employees clothes—high-pressure steam (through a line unknown to the manager) to operate a process kettle.

Discovered through meters, both of these wastes stopped immediately and completely. Similar experiences are reported from practically every plant installing departmental meters.

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POWER Stands for . .

1. **Making Power When It Should Be Made**
2. **Buying Power When It Should Be Bought**
3. **Cheaper Power Through Modern Equipment**
4. **Easier Financing of Equipment Purchases**
5. **Better Use of Byproduct Heat and Power**
6. **Operating Methods That Save Money**
7. **Less Waste in Transmission and Application**
8. **Prevention of Smoke, Within Reason**

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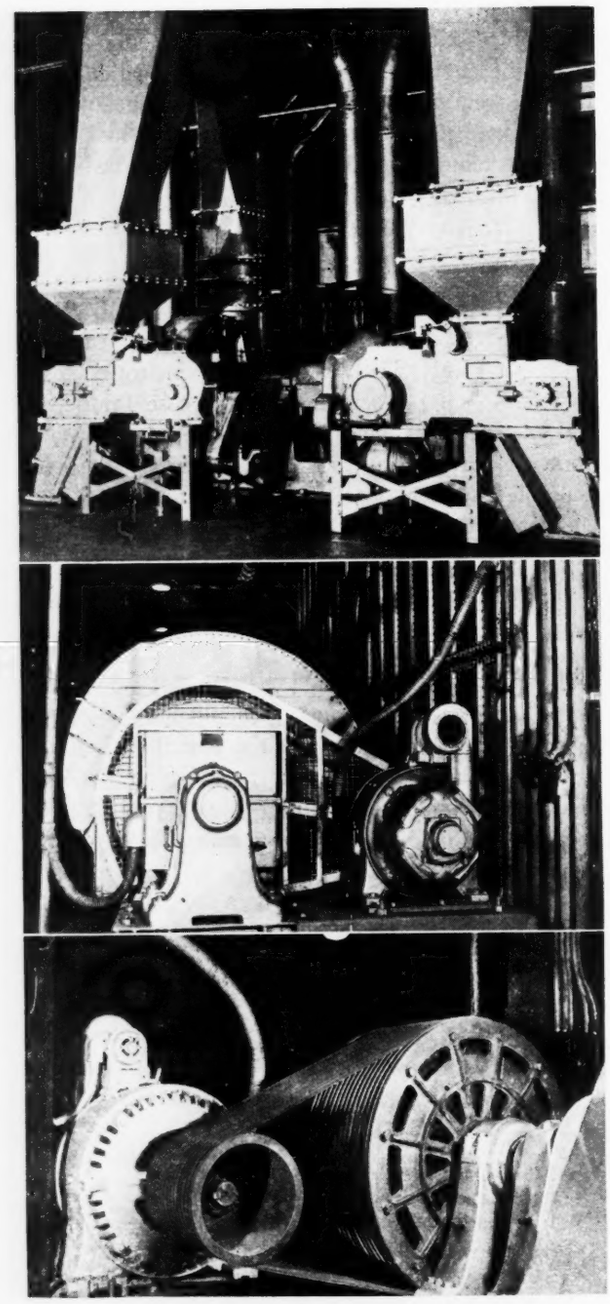
Simplified Automatic Combustion Control AT POWERTON STATION



Figs. 1 to 3—(Above) pulverized-coal feeders; (center) one of the six Buffalo turbine-conoidal 70,000-cu.ft. forced draft fans; (below) this view shows the Texrope connection between direct-current motor and the alternating-current motor frame on one of the six 110,000 cu.ft induced-draft fans

Three pilot-motor-operated field rheostats make all the necessary adjustments in fan and fuel feeder speeds on each boiler to regulate for steam demand. Secondary adjustments of one or more of the same rheostats by individual boiler controls maintain the proper furnace pressure and the proper ratio of air to fuel

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OVER a year ago the excellent performance of Powerton station was described in these columns.[1] At that time two 55,000-kw. units were in operation. A third unit of 105,000 kw. capacity went into service in December, 1930, and the station capacity is now being brought up to 320,000 kw. by a fourth unit identical in design and capacity with the third. The article referred to made some mention of these later units by pointing to the variations in unit assembly introduced.

One of these variations consisted of the adoption of the Rossman system of adjustable-speed drive for the forced- and induced-draft fans in preference to the three- and two-speed squirrel-cage motors used with the initial installations. To take full advantage of this new method of driving the fans a new and simple system of automatic combustion control was developed. This control functions by simultaneously increasing or decreasing, in the proper ratio, the speeds of the forced-draft fans, the induced-draft fans, and the speed of the pulverized-coal feeders to meet a change in the demand for steam. While these adjustments are being made to the group as a whole to regulate for steam demand, secondary adjustments are made on the individual controls to maintain the correct furnace pressure and the proper ratio of air to fuel. Three pilot-motor-operated field rheostats in combination with Bailey master and individual boiler meters make all the necessary adjustments on each boiler.

Before going into detail a brief summary of unit equipment supplying fuel and air will be desirable. Unit No. 3 is a 105,000-kw. three-barrel tandem-compound turbine driving a single generator. Steam is supplied by two standard boilers, each having 33,000 sq.ft. of steam-making surface with a normal hourly output of 450,000 lb. of steam, and a reheat boiler whose chief

[1] *Power*, June 10, 1930.

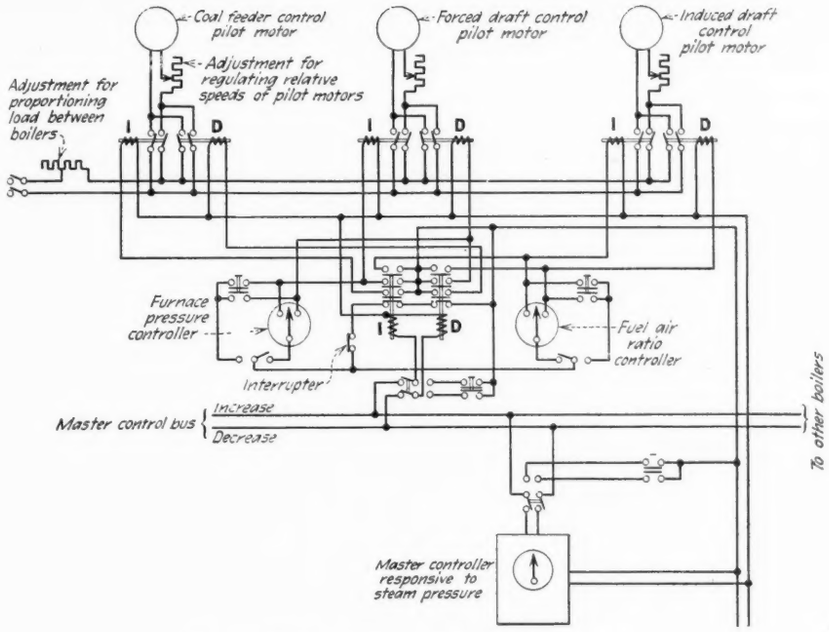


Fig. 4—Wiring diagram of simplified system of Rossman-Bailey automatic combustion control

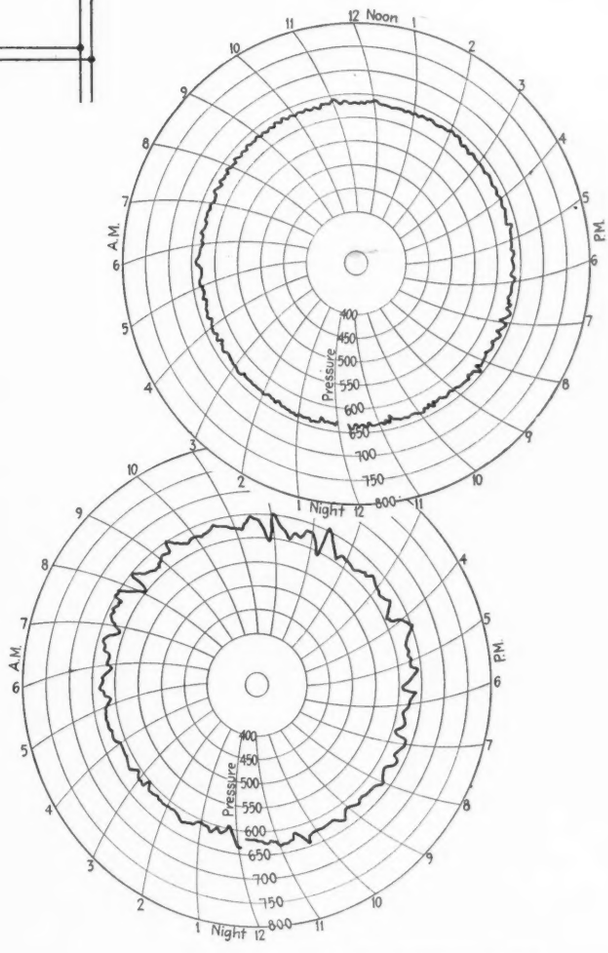
function is to reheat the steam between elements of the turbine. The operating steam pressure is 630 lb. gage.

Each boiler is equipped with three unit-type coal pulverizers, each pulverizer being complete with one belt feeder and one exhauster. The pulverizer and exhauster drives are 2,300-volt constant-speed squirrel-cage motors. The feeder motors are adjustable-speed separately excited direct-current machines arranged for Ward Leonard speed control. With the type of mill used the rate of fuel feed to the furnace responds quickly to the rate of coal input to the mill. Control of the rate of fuel feed is accomplished simply by means of a motor-driven rheostat that regulates the field of a small motor-generator set supplying variable voltage to the armatures of the three direct-current motors driving the coal feeders for the three mills on each boiler.

Draft equipment for each boiler consists of two induced- and two forced-draft fans, each fan being driven by the Rossman system, of adjustable-speed drive. This type of drive, which was described at some length in the Aug. 19 and Oct. 21, 1930, numbers of *Power*, consists of a squirrel-cage induction motor supplemented by an adjustable-speed direct-current machine of much smaller size. The frame of the alternating-current motor is mounted on bearings so that the frame as well as the rotor may rotate. The frame is mechanically connected by means of Texropes to the direct-current machine, which controls the speed and direction of rotation of the alternating-current motor frame. The fans are controlled throughout a range of approximately $2\frac{1}{2}$ to 1 by varying the speed of the direct-current machine, and, therefore, the alternating-current motor frame, through a range extending both above and below the constant speed of the alternating-current motor. The speed of the fan is thus the fixed speed of the alternating-current motor plus or minus the speed of its frame. One motor-generator set controls the auxiliary direct-current machine on the two forced-draft fan drives on each boiler, and another set controls the two induced-draft fan drives. The speed range below the fixed speed of the alternating-current motor may be extended beyond the limits of armature voltage control by field control of the direct-current motor, on account of the much lower torque required by the fan at reduced speeds.

To effect proper distribution of load, the two induced-draft, and likewise the two forced-draft, fans of each boiler are operated at the same speed, this being accomplished by connecting the two fields, as well as the two armatures, in parallel. A motor-driven rheostat of Cutler-Hammer design regulates the speed of each pair of fans by a combination of generator and motor field control.

Advantage was taken of the simplicity and smoothness of draft and fuel feed control to simplify the automatic combustion control. The characteristics of the control of the fuel feeders, forced-draft fans and induced-draft fans were designed as nearly alike as possible. By designing the three speed-regulating rheostats for the forced draft, induced draft and the fuel feeders with straight-line characteristics, and then making individual adjustments on the speeds of the pilot motors by means of small rheostats in each pilot-motor circuit, an impulse given simultaneously to the three rheostat pilot motors adjusts the fuel and draft



Figs. 5 and 6—Steam pressure charts with master control (above) functioning, and (below) with master control off and speed changes of fans and feeders effected manually by push button

in as nearly correct proportion as possible. Secondary corrections are periodically made to compensate for any divergence of furnace pressure or fuel-air ratio.

The Bailey automatic combustion control equipment consists of a master steam pressure controller, which regulates the output of all boilers to suit the load demand, and an individual boiler controller for each boiler, which introduces the secondary corrections for furnace pressure and fuel-air ratio. The physical arrangement of the master and individual control panels with respect to the boiler, fuel feeders and fans is shown in Fig. 10.

Operation of this system can be explained with the aid of the schematic diagram, Fig. 4. The master controller, of standard proportional step type, consists of an oil-operated piston similar to a deadweight tester which measures the header steam pressure. An increase or decrease in steam demand produces a corresponding fall or rise in steam pressure. The master contactor then sends out an electrical impulse proportional in length to the rate of deviation of steam pressure. These impulses are sent out on the master control bus, consisting of two conductors, one for "increase" and the other for "decrease." The impulses actuate a pair of master relays on each standard boiler, which operate simultaneously the reversing contactors controlling pilot motors on induced draft, forced-draft and fuel-feeder control rheostats.

An increase in steam demand will therefore produce a drop in header steam pressure, which causes the master controller to send out impulses to the "increase" relays on each boiler. These relays cause the pilot motors to adjust the rheostats to increase the speeds of the fans and coal feeders. If the resistors in the pilot motor circuits have been correctly set the three pilot motors will advance their respective rheostats to maintain as nearly as possible correct furnace pressure and combustion efficiency.

However, owing to changes in draft resistance, quality of fuel, etc., there always will be a small divergence. Between impulses of the master controller, the individual corrections are made on each boiler. The furnace pressure controller adjusts the forced-draft fans to maintain a small negative pressure in the furnace, and the efficiency of combustion is correctly maintained by holding the proper ratio of steam flow to air flow, which is closely proportional to the fuel-air ratio. The corrective action of these controllers is periodically broken up by means of an interrupter into definitely timed impulses in order to prevent hunting.

The normally closed contacts on the master control relays are in series with this circuit, so that the corrective impulses are interrupted whenever the master controller is operating. An adjustable resistor is inserted in the supply circuits to all the pilot motors of each boiler, and in this way the relative rates of response of the boilers to pressure changes may be adjusted.

Instead of responding to steam pressure, the reheat boiler is regulated to maintain constant reheat steam temperature, so that this boiler does not come under the influence of the master control. Unit No. 4 probably will go into service the latter part of 1932. At that time the present master controller will regulate the steam output from the four standard boilers of the two latter.

Compared with the equipment on Units 1 and 2, which consists, respectively, of three-speed and two-speed squirrel-cage motors for driving the fans and the dampers controlling the

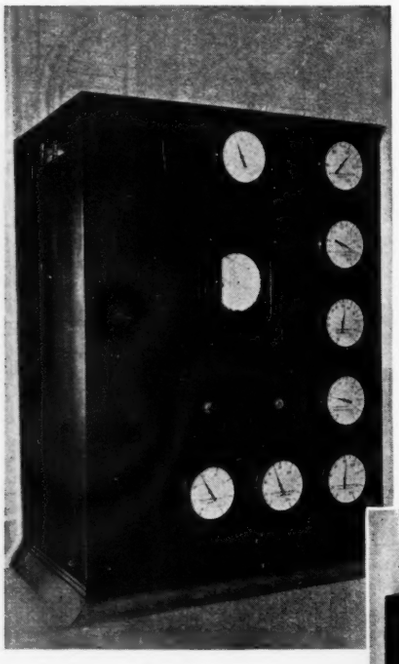


Fig. 7 (Left)—Master panel with master steam pressure contactor and recorder, master drum switch, numerous indicating pressure gages and a liquid level indicator

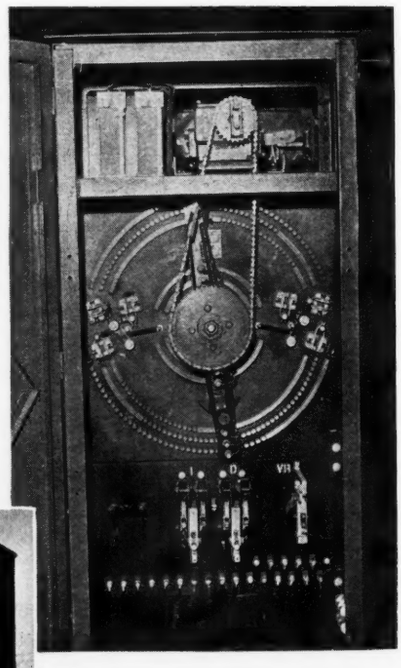


Fig. 8 (Right) — One of the motor-operated potentiometer type rheostats for field control of the regulating motor-generator sets and the direct-current machines of the Rossman drive

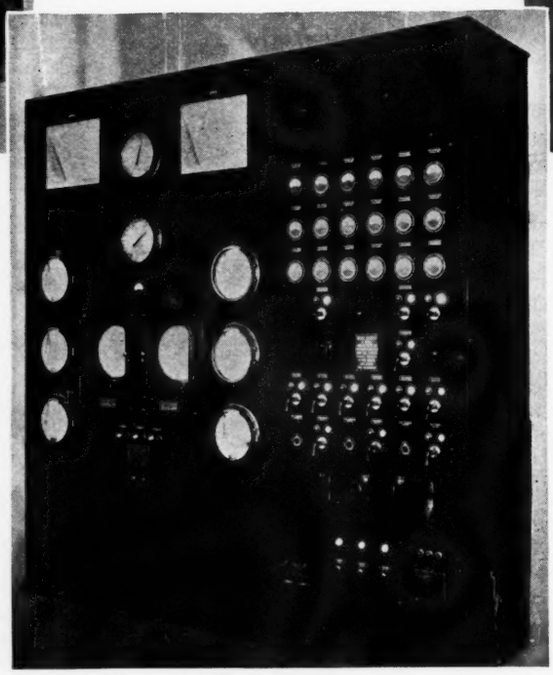


Fig. 9 (Below)—Individual boiler panel with totalizing boiler meter, steam-flow air-flow and furnace-draft contactor, drum switch, and the usual draft gages and temperature recorders

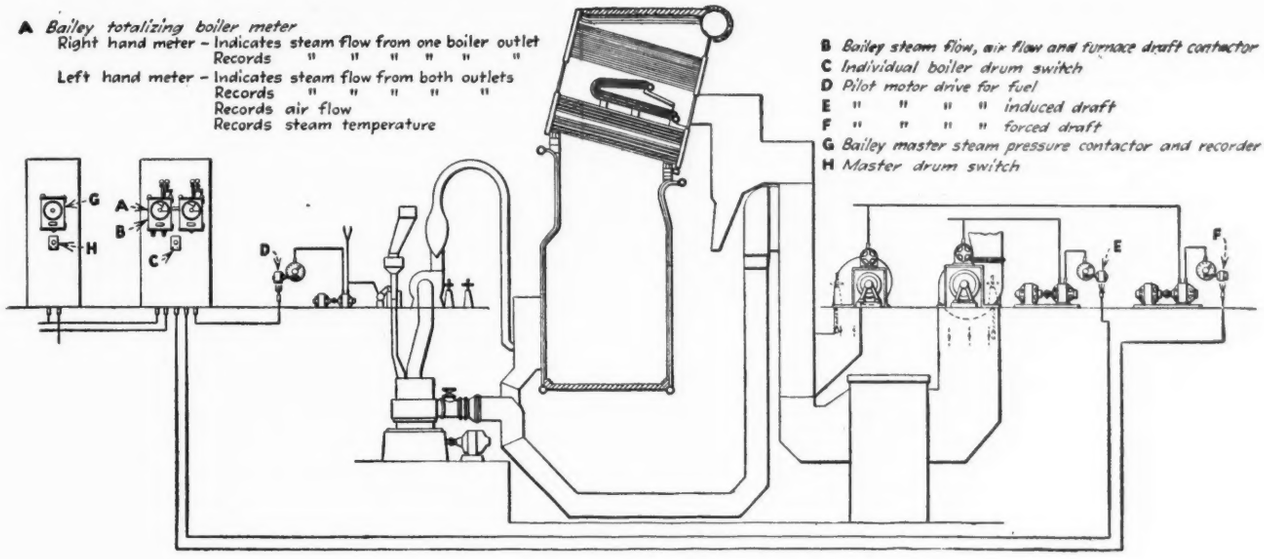

A Bailey totalizing boiler meter
Right hand meter – Indicates steam flow from one boiler outlet
Records " " " " " "
Left hand meter – Indicates steam flow from both outlets
Records " " " " "
Records air flow
Records steam temperature
B Bailey steam flow, air flow and furnace draft contactor
C Individual boiler drum switch
D Pilot motor drive for fuel
E " " " " induced draft
F " " " " forced draft
G Bailey master steam pressure contactor and recorder
H Master drum switch

Fig. 10—Diagrammatic drawing illustrating the application of the automatic control equipment

draft, the new system has some very definite advantages. One is the simplicity and smoothness of the speed control over the entire range from 450 to 1,100 r.p.m. With the multi-speed motors for fan driving, a change in load, necessitating a change in motor speed, calls for a switching operation, movement of the dampers both before and after the switching, and, when dropping from the higher to the lower speed, the proper timing of the switching operation to prevent undue mechanical stresses on the equipment. All of these operations must be controlled by the automatic combustion control system, which, of course, adds to the complication.

In the changeover in speed considerable disturbance is created. Trouble developing with the automatic speed-changing equipment necessitated its elimination, and as a result changes in fan speed on units No. 1 and 2 are now made manually by means of selective switches on the control panels.

Present practice at the station is to operate the standard boilers of Units No. 1 and 2 at steady rating, allowing No. 3 unit to take the swings. Normally, throughout the day the load runs close to 200,000 kw., with peaks up to 220,000 kw., while the night load drops to a minimum of 100,000 kw. Fig. 5 shows that the header pressure is maintained within a ±10-lb. of the 630-lb. operating pressure, and for much of the time within 5 lb. either way. With No. 3 unit operating alone, or when No. 4 comes on, even better results are anticipated, owing to the more uniform control and the larger capacity in boilers swinging automatically. Fig. 6 shows the same combination of units operating without the master contral. Here the pressure swings during the variable-load period of the day are 25 to 30 lb. above or below normal.

Possessing these advantages, the new system of drive and combustion control was installed at practically the same initial cost as the original equipment. The lack of complication should—and has for the seven months during which No. 3 unit has been in service—result in lower cost and greater ease of maintenance. In fact, the maintenance has been practically nil during this period. Owing to variable-speed operation, as compared to continuous full speed at 900 or 1,200 r.p.m., erosion of the fan blades and housing should be less, but a longer period will be required to prove this.

It is evident that there should be substantial savings in energy owing to the more efficient fan and feeder control. Tests made of Units No. 1 and 3 gave such an indication, notwithstanding the differences in boiler outputs and static air pressures.

Reports from the station operators indicate that the new combustion control system is dependable. It functions smoothly and efficiently day after day with little or no attention. Repairs have been few and minor in character. A change necessitated by vibration has been the transfer of the direct-current motor of the fan drive from a structural-steel base above the unit shaft to a solid concrete foundation at the side of the shaft. The new location is shown in one of the accompanying photographs.

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Economical Operation of Air Compressors

FEW PLANTS use specially treated water for the cylinder jackets of air compressors. In most plants where city water is not available the jackets are usually supplied from the same supply as the condenser circulating pumps, being protected only by a strainer. Usually this water is hard and contains much scale-forming matter. And after a few months' operation, or maybe a year, the water jackets are scaled up. Flushing out will remove the loose dirt, but not the scale.

When the jackets become scaled the temperature of the cylinder will be much higher than usual, but the air receiver will not heat up if aftercoolers are used. The efficiency of the compressor, however, will be much lower than under normal operating conditions. Scale can generally be removed by draining the jacket while hot (just after shutting down) and filling with a 10 per cent hydrochloric solution, a soda ash treatment or any good scale-removing compound. This should be allowed to stand in the jacket several hours, then drained and flushed out with water at high velocity.

When air compressors are allowed to operate at too high temperatures it causes the oil to break down. This results in more rapid wear, irregular valve operation and even (in some cases) in the cylinder being scored; also carbon forms faster.

What Do Engineers Earn?

More than 50 per cent of A.S.M.E. membership contributes to answer now made public

FOR YEARS engineers have been concerned about their earnings. That the engineer was or was not adequately paid for his services was the heart of many an argument.

It was inevitable that the engineer would eventually apply his own methods to the study of this problem, and that he would thereupon seek the facts as the first step. That step has now been taken. Last year the American Society of Mechanical Engineers appointed a committee of nine prominent engineers, with Conrad N. Lauer as chairman, to gather the dollar facts, analyze them by sound statistical methods, and present the finding to the society.

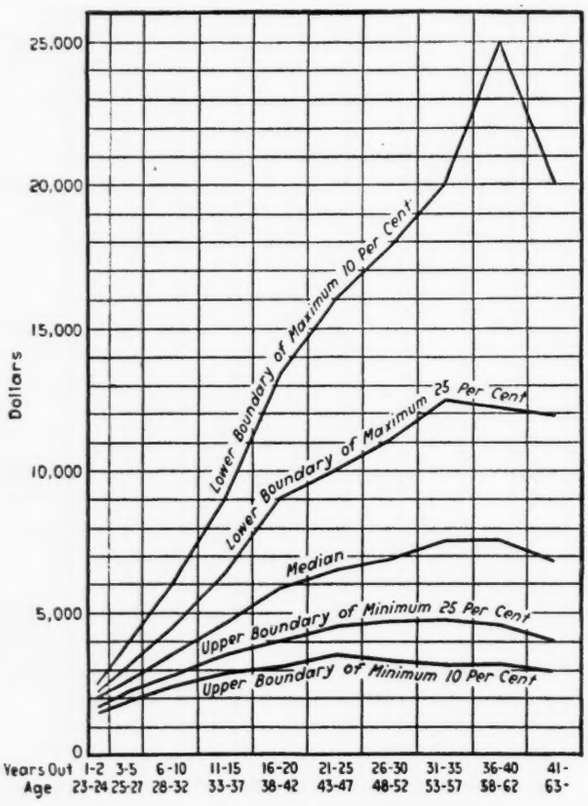
25,000
20,000
15,000
10,000
5,000
0
Dollars
Lower Boundary of Maximum 10 Per Cent
Lower Boundary of Maximum 25 Per Cent
Median
Upper Boundary of Minimum 25 Per Cent
Upper Boundary of Minimum 10 Per Cent
Years Out 1-2 3-5 6-10 11-15 16-20 21-25 26-30 31-35 36-40 41-
Age 23-24 25-27 28-32 33-37 38-42 43-47 48-52 53-57 58-62 63-

Fig. 1—1930 Earnings of mechanical engineers—U. S. as a whole (exclusive of salaries of teachers and of employees of the federal government)

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The median United States engineer earns $2,700 at the age of 26; $3,500 at 30. At 45 he has about $6,500, and at 50, $7,000. His peak of $7,500 is reached at the age of 60

Questionnaire Insures Secrecy

To each A.S.M.E. member was sent a questionnaire asking the amount of his professional earnings, together with detailed information regarding his education, job, etc. To insure complete secrecy the replies were not signed. More than 50 per cent of the members furnished replies—certain proof of the great interest in the problem and the desire to cooperate in its solution. In conducting the survey and preparing the report, the Committee on the Economic Status of the Engineer enlisted the cooperation of Prof. Elliott Dunlap Smith, of Yale University. The statistical computation was directed by Prof. Hudson B. Hastings, also of Yale University.

The complete report has now been prepared and will appear in the September number of *Mechanical Engineering*. The present article, based on that report, includes all of the six curves there presented to sum up the data.

Figures Based on Median, Not Average

In the interpretation of these reports several points should be kept in mind. First, they are based on 1930 earnings and do not reflect, to any great extent, the influ-

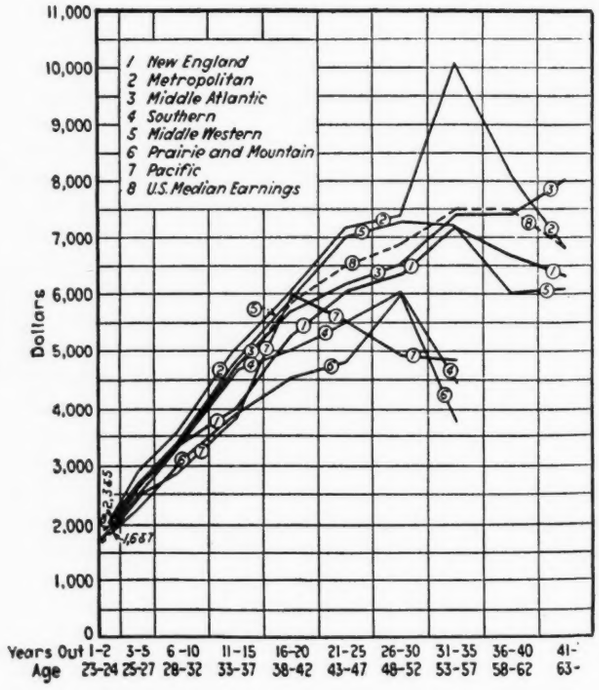


Fig. 2—1930 median earnings by geographical areas

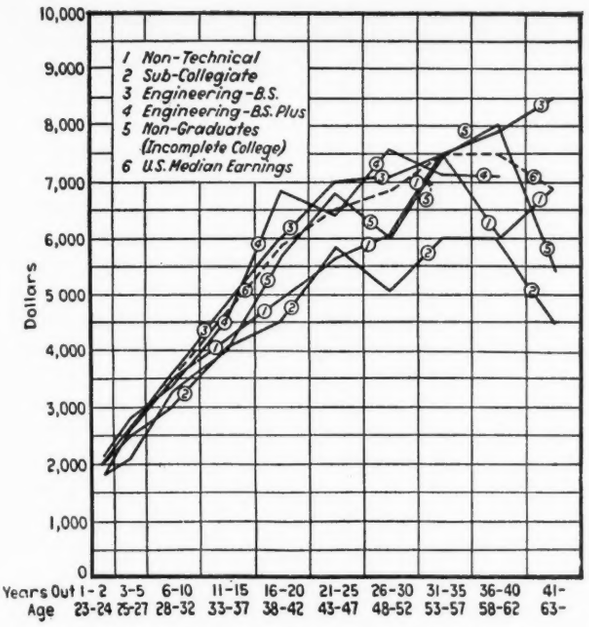


Fig. 3—1930 median earnings by type of education

ence of the depression. Second, the figures refer to professional income only, and do not include income from investments and other sources. Third, the figures do not refer to average, but to *median* earnings. The *median* earnings are the earnings of the *typical* engineer, who is the "middle man" of the group, with as many men above him earning more as there are below him earning less. The *median,* in short, is the half-way line.

To modern statisticians the median is more enlightening than the average for most studies. The median may be higher than the average, lower than the average, or equal, depending on the variable being studied. For example, if nine men have salaries of $2,000 $3,000, $4,000, $5,000, $6,000, $7,000, $8,000, $9,000 and $10,000, respectively, the median is $6,000. That is, the $6,000 man has as many men earning more as he has men earning less. Financially he stands in the middle and may be considered as typical of the group. In this case the average is also $6,000.

Suppose, however, there are only five men, whose earnings run $2,000, $3,000, $4,000, $5,000 and $10,000. The average of this group is $4,800, but the median (salary of the half-way man) is $4,000, and the latter is probably more typical of the group than the former. The committee reported that in the case of engineering salaries the mathematical average would be far above the median.

Typical Engineer Attains $7,500 Maximum

It will be noticed that all of the curves shown give earnings in terms of years out of college, and of age, but that these years out and ages are given in groups rather than in terms of single years. By grouping several years together the committee was able to include a much larger number of men in each group and thus increase the reliability of the findings.

Finally, it is important to notice that the curves do not show the progress of the median individual from the time he was graduated, but are rather an instantaneous snapshot in 1930 of the earnings of various age groups. That is to say (referring to Fig. 1) the median earnings in the 38-42 age groups were $5,900, and in the 53–57 age group, $7,500. Note that these are two different sets of men.

Managerial medians surpass non-managerial medians throughout, being approximately 25 per cent more at 30 years af age, and increasing consistently with age until they are more than 100 per cent above at 55 years and over

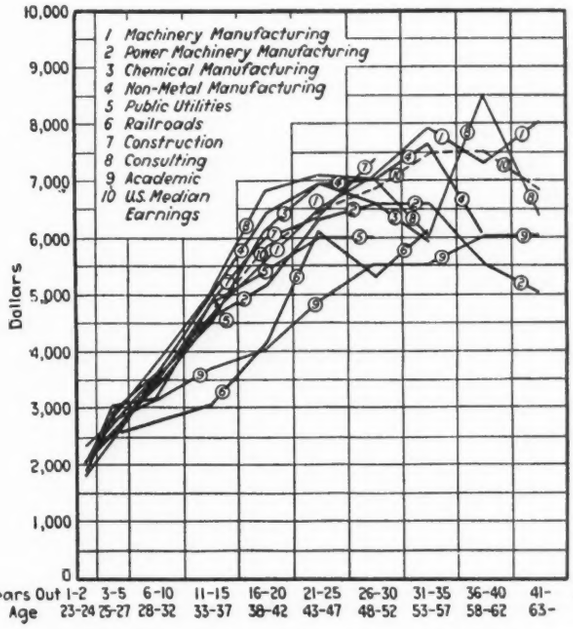


Fig. 4—1930 median earnings by type of industry

Based on returns from more than 50 per cent of the A.S.M.E. membership, the maximum earnings of a typical engineer are $7,500, reached somewhere between the ages of 53 and 58 years. As the committee puts it in its report, "If median 1930 earnings are considered as earnings of the typical engineer, and it is assumed the typical engineer marries at 26 years of age, and has two children at 30, who grow up and go to college, the balance sheet of earnings and responsibilities on the 1930 basis will be about this: He will have about $2,700 to marry on; when a second child is born he will have about $3,500 to support his wife, his two children and himself. When he is 45, and his children are entering high school, he will have about $6,500 for his family income.

"At 50, 28 years after he himself was graduated from college, he will have two children in college and earn about $7,000 a year. If he gives each child $1,000 a year for tuition and expenses he will have $5,000 left to support his wife and himself. At 60, with his children presumably self-supporting, he and his wife will have $7,500 a year to spend, but must look forward to a decline in earning power to $6,800 after 63."

Earnings Highest in New York City

The survey showed a considerable difference in earnings in various geographical districts (Fig. 2). The New York metropolitan district tops the list, particularly with the older men. The committee pointed out, however, that living costs are higher than average in New

York City, and that this might practically equalize all of the apparent advantage of New York state earnings. The chart is notable for the lower earnings, particularly of the older men, in the Prairie and Mountain, Pacific and Southern States.

In the metropolitan district (New York City and vicinity) the maximum median salary is $10,000. In the Middle Atlantic States it is $8,000, in the Middle West $7,300, in New England $7,200, in the Southern States $6,000, in the Pacific States $6,000, in the Prarie and Mountain States $6,000.

Fig. 3 shows the effect of education upon earnings. The numbered descriptions require further explanation. "Engineering-BS plus" comprises those men who added a year or more of technical graduate work to their BS degree. "Non-graduates" spent at least three years at a recognized engineering school, but did not get their degree. "Sub-collegiate" includes all men whose education comprised a course of study of at least three years in a night school or school of less than college grade. "Non-technical" includes all men whose training is less than "non-graduate" or "sub-collegiate."

An interesting revelation of this chart is the fact that after 55 the men with graduate training earn less than the men with standard engineering-school training, possibly due to the fact that they tend to stay in strictly research positions and do not become general executives.

In the chart for earnings by industries (Fig. 4), "chemical manufacturing" includes oil, mining and metallurgical. "Machinery manufacturing" includes electrical equipment, automobiles, airplanes and metal products. "Power machinery manufacturing" includes, in addition to stationary power machines, refrigeration, heating and ventilating equipment. The classification "Consulting" (as is the case with the others) refers to the business and not to the individual.

Power Machinery and Public Utilities Fall Off

It is notable that after the age of 35 median earnings in "power machinery manufacturing" and "public utilities" fall off distinctly. By the age of 60, it is pointed out, power machinery pays almost $2,000 below the United States median wage. The public utility figures are not carried beyond the age of 52, because insufficient data were received. It will be noted that the railroads pay below the median wage almost from the start.

The earnings given in Fig. 5 refer to the job of the individual, rather than the company with which he is connected. In this group "designing" includes all industrial research. "Technical operation" includes all maintenance, inspection, production control, and similar technical work relating to operation. "Consulting" as a type of job includes only actual consulting, and does not include employees of consultants, as an industry does (Fig. 4).

"General management" includes all men in general executive work, from assistant foreman up. "In classifying men by type of work," the committee reported, "an effort was made to include under each special type of work all work of that character, regardless of whether the job could also be considered managerial, so that a man would not shift from one of the technical classifications to general managerial classification merely because he progressed in his work to a position involving executive duties. For example, a vice-president or other executive concerned with research would be classified in the designing group.

"In the same way, a plant engineer or other power executive would be put in the technical operating group, regardless of the executive nature of his position. No one was put in general management group unless his job was not only of a managerial character, but did not fall into any of the other special types.

"Teaching and those jobs where technical skill is a primary qualification ('technical operation' and 'designing') are paid on about the same scale, and throughout distinctly less than the median of the United States as a whole. Teaching shows a somewhat lower earning power than technical work between the ages of 30 and 40, and a distinctly higher earning power above 55."

Managerial Ability Pays Better Than Technical Skill

In view of the reputed high earning of salesmen, it is interesting to note that "the median for buying and selling follows closely the median of the United States as a whole for the age of 45, but that after this age it falls distinctly below." It is clear that "work which involves primarily either the capacity to handle independent business, and to meet people as consultants, or the capacity to manage men and affairs as general managers, is consistently well paid, general management especially soaring in earning power." On this point the report continued: "Not only is there a striking difference between general management and consulting on the one hand, and design, research and technical operation on the other, but there is a significant difference in earnings, especially among engineers and research men, between those engineers doing technical work who have managerial duties, and those who do not.

"A broader indication of the influence of the possession of managerial ability upon the progress of engineers and their careers is shown in Fig. 6. There all men doing executive work in industry are grouped in a single classification as industrial managers, regardless of whether their executive duties relate to general management, design or research management, or to management

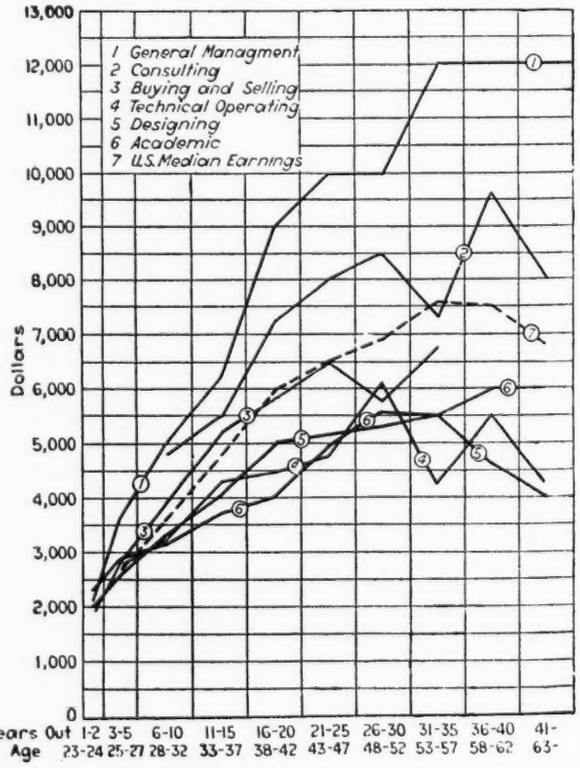


Fig. 5—1930 median earnings by type of occupation

in the field of technical operation. Similarly, all technicians whose work does not include substantial executive responsibility are grouped in one classification as industrial technicians, regardless of whether they are designers or do technical operation work.

"The median earnings of industrial managers correspond with striking closeness to those of consultants at almost all ages. 'Industrial technicians' earn about the same as academic men until 42, after which age the teachers earn substantially more."

"A comparison of the chart for type of job with those of different industries indicates that while academic institutions pay less than almost any other employer, the earnings of teachers compare favorably with earnings in the technical branches of engineering."

It Will Pay Engineers to Learn Management

The committee concluded: "Regardless of whether the grouping is by type of technical functions, or by the managerial and non-managerial responsibilities, the difference between managerial and consulting earnings, and all others, is so great as to suggest the importance to young men well trained in engineering of seeking to add to their engineering ability some capacity for dealing with people, or for managing organizations or businesses."

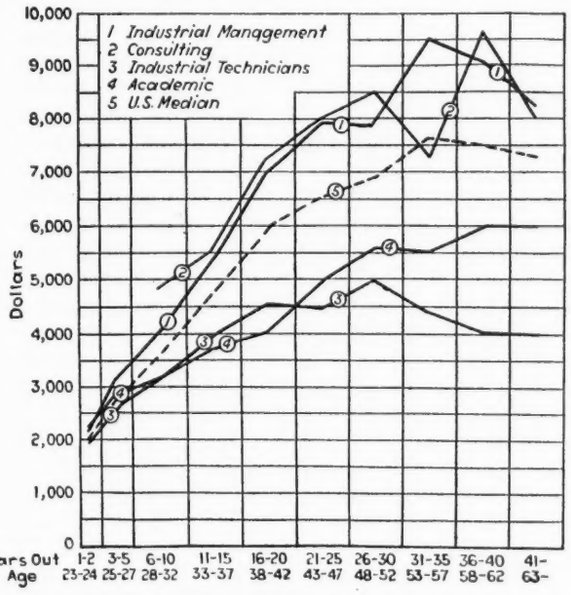


Fig. 6—1930 median earnings by nature of work

The Committee on the Economic Status of the Engineer had the following personnel: Conrad N. Lauer, chairman; C. F. Hirshfeld, Dexter S. Kimball, H. B. Oatley, W. A. Starrett, H. L. Whittemore, W. E. Wickenden, James M. Todd and C. E. Davies.

●

Many plants where the power load frequently exceeds the steam load make use of the diesel engine as a stand-by unit. In spite of the very high efficiency of the diesel engine, it is less efficient than a steam unit whose exhaust is fully utilized. The diesel, however, is more efficient than a condensing unit of a size that would be used in an industrial plant, and, of course, far more efficient than a steam unit exhausting to atmosphere. The diesel, therefore, should be loaded to the point where it will prevent waste of steam to the atmosphere, or of exhaust heat to condensing water.

Is Customer Inspection of Plant Equipment Necessary?

By H. M. FRIEND

It costs money for the customer to inspect the equipment he purchases. It also sometimes saves him a lot. The arguments pro and con are here presented.

THE QUESTION is often asked, "Is customer's inspection of power-plant equipment necessary and is the cost justified?" We shall assume that the manufacturer has a fully equipped inspection and testing department, that his entire output is inspected and tested before shipment. Therefore the problem is whether the requirements of the customer are fully protected by the manufacturer's own inspection.

Let us now examine what these requirements are:

1. That the materials and equipment are in accordance with his description, drawings and specifications which were incorporated in the order.
2. That there are no mechanical or electrical defects in the equipment which will affect its operation.
3. That the required quantity, quality, thickness of materials are provided and that no corners are cut by the manufacturer to make possible a low competitive bid.
4. That the specified operating characteristics are provided. For example, efficiency and head of pumps, efficiency, power factor, heating limits for electrical equipment.

In the first part of this article we shall present the arguments to show that customer's inspection is not required and that his requirements are fully protected by the manufacturer's own inspection. Then we shall present the advantages of customer's inspection.

Arguments Against Customer Inspection

It is contended that as the manufacturer has his own inspection and testing department his entire product has been completely tested before shipment and the customer's inspection is a needless repetition of this work. Any defects in the equipment will develop in this factory inspection and will be repaired by the manufacturer for his own protection.

Also, the manufacturer guarantees and stands back of his product and will replace any defective material or equipment which develops in operation. Therefore the customer is fully protected by the integrity of the manufacturer.

The customer's inspection places additional costs on the manufacturer. As the manufacturer, for his own protection, often makes his own inspection first, this will mean two inspections instead of one. The manufacturer must operate at a profit to stay in business, and additional costs incurred by the customer's inspection will eventually be passed along to the customer in increased prices.

Attention is called to the fact that inspection by the

customer requires a certain amount of time and thus prevents shipments going forward at the earliest possible moment, delays receipt of the equipment at the job and thus reacting to the disadvantage of the customer.

One of the chief arguments against customer inspection is the cost to him of maintaining an inspection department. This cost must be added to the price which he pays for the equipment.

Finally, it is contended that since there is a large amount of equipment which never received customer's inspection and which has proved satisfactory in service it is evident that customer's inspection is unnecessary.

Advantages of Customer Inspection

The advantages claimed for customer's inspection are:

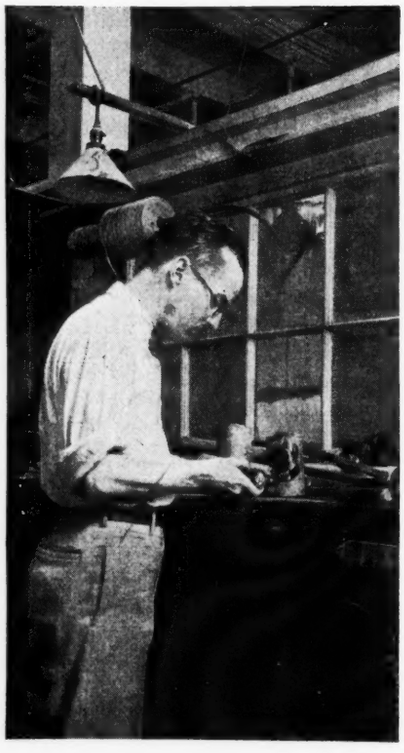
The customer has actually ascertained through his own representative that the materials and equipment are in accordance with his specifications and requirements instead of depending entirely on the manufacturer.

He has actually seen whether there are mechanical or electrical defects in the equipment and if they have been properly overcome before shipment.

He has actually checked the quantity, quality, thickness of materials and proved to his own satisfaction that the equipment is in accordance with his requirements.

By actual test he has obtained data on the operating characteristics of the equipment, such as efficiency, power factor, etc., and has checked the computed values.

At the construction job there are probably no testing facilities or trained personnel available for checking and testing the above-mentioned requirements. If the customer's inspection is not conducted at the manufacturer's plant it may never be made.



In the inspection work there may be a reasonable doubt regarding the suitability of the equipment. The manufacturer's inspection department will naturally look at the matter from the viewpoint of their company's best interests, while the customer's inspector looks at the question from his company's side and can take disputed points to his own engineering department for decision.

The manufacturer's guarantee and his integrity in replacing defective equipment may be beyond question. But when will these defects show up? If they are not caught before shipment they may not develop until the plant is in operation and may cause a shutdown of the entire plant, or even loss of life. The manufacturer may make good eventually on the replacement of his defective equipment, but can never cover the total loss. Customer inspection tends to lessen such occurrences.

If materials and equipment not in accordance with the customer's drawings reach the construction job is may be necessary to return them to the manufacturer, thus causing serious delays in the installation work.

Customer inspection protects him from the dishonest manufacturer who may make inferior substitutions and lower quality of the product to reduce his cost. When the manufacturer knows that the customer will inspect the equipment he takes more pains with it. Some companies which had considerable rejections by the customer's inspector have been forced to reorganize their inspection departments. In some cases manufacturers have been known to offer rejected equipment to customers that had no inspectors of their own.

In regard to the cost of customer inspection, it will depend to a considerable extent upon the size of the company and the steadiness of the work. Where the company maintains an expediting department the inspection work can be handled by this same department to reduce the cost. A small company that does not maintain an inspection department may give the work to an inspection company. In some cases the customer may make temporary use of their engineer, who specified the equipment, to conduct the inspection.

The writer has often thought, in his purchasing of personal equipment, such as cameras, radios, automobiles, that he would gladly pay a percentage fee to have a certificate of inspection from an expert and unbiased organization covering the mechanical features of the equipment, and that the cost would be more than justified by the assured operation of the equipment.

The final decision as to whether the cost of customer inspection is justified should be made after seriously weighing the disadvantages against and the need for this work. Most of the larger railroads, public utilities, consulting and construction engineering companies evidently think the cost justified, as they maintain inspection departments. Certain products are almost universally inspected. Among these are insulated wire and cable, transmission line conductors, electrical insulators, condenser tubes, structural steel, etc.

In actual inspection work some interesting cases where customer inspection forestalled serious trouble have been witnessed. A small manufacturer supplied a transformer-oil purifying outfit for a customer in Honolulu. He objected to the customer's inspection, but when forced to yield it was discovered that the oil piping in the equipment was defective, which made operation impossible. The defect was corrected before shipment, thus saving no end of trouble at the other end.

An order for a quantity of special electrical switchboard instruments was garbled by the order department of a manufacturer in preparing the factory order. Without customer inspection the error would not have been discovered until the meters reached the job, and it would have required two or three months to obtain the required meters, which were special and built from parts made up for that particular order.

The calibration of electrical measuring instruments is checked as a matter of routine by the manufacturer's testing department. In actual practice it is surprising to find many defects in calibration. At the construction job this would not be caught until the routine operation of the plant provided for checking all meters.

These are only a few samples of savings resulting from customer's inspection.

Russia Standardizes Elevator Specifications

By R. P. VALTIER
Consulting Engineer to the Soviet Government
Moscow, U. S. S. R.

ELEVATORS have been standardized in Russia and this article gives an idea of what can be done under certain conditions. It should be mentioned that in making the standards American practice was followed as closely as possible under local conditions. This was done so that costly experimental work could be avoided. The apparent irregularity of the figures given is due to the plan's being based on the metric system of measurements.

One fact makes these standards possible. The government industries are coordinated to such an extent that we were able to assume a convenient range of car sizes and insist on their adoption by the users. Conditions relating to the sale of an elevator in Russia are directly opposed to those existing in other countries. The organization building the elevator has the authority to tell the architect exactly what his requirements are as to size, speed, control, etc., and also to see that equipment selected by the factory and not the architect is installed in the building. The architect is then required to build the hoistway to suit the elevator, and all costs connected with this item of the building's equipment are thereby reduced.

Previously car sizes had been governed entirely by the requirements of the architect, with the result that no two cars were of the same size or capacity, and hopeless confusion existed in the shop. Our method was to select nineteen car sizes and to standardize on the loading and equipment, which automatically determined the total weight of each car and its equipment. When this was done, hoisting machines, safeties, buffers, counterweights, motors, cables, etc., were all determined to such a degree that "each complete elevator could be taken from the shelf."

The first step was to determine loading rates to be used for various sizes of cars. For passenger cars we used the well-known 150 lb. per passenger, and the area per passenger was determined by rules laid down in the A.S.M.E. safety code. Freight-elevator loading rates were determined from a study of previous manufacturing records and maximum floor loads used in Russian and American building practice. The figure finally determined upon was 1,760 lb. per square meter (800 kilos), or 160 lb. per square foot. We were then able to compile the table given herewith.

With this table completed it was comparatively simple to calculate all necessary steel for each car. These calculations completed, it was possible to construct a table of the car details. This was done for all car sizes shown in the table. From the table of car details it is possible to determine in advance the necessary sizes of structural shapes to be carried in stock. Each part can be manufactured from standard drawings and the mechanics can be trained to make one particular part without reference to its related members.

Car speeds were standardized and based on 1-to-1 and 2-to-1 roping; gear reductions, standard motor speeds, and sheave diameters. The maximum speed was limited to 400 ft. per minute, this being sufficient for the needs of the near future, but the plan can be enlarged to permit of up to 1,000 feet per minute.

Motor speed was selected from the standard lists furnished by the motor builders. For car speeds of over 150 ft. per minute direct-current machines have been selected, with, if necessary, motor-generator sets and Ward Leonard control.

Sheave diameters were selected as being not less than 43 to 45 times the diameter of the ropes used and not greater than $1\frac{1}{2}$ times the diameter of the gears which drive them. The former figure, while purely empirical, is based on many years of rope practice, and the later figure was selected after a mathematical study of the most economical point at which the size of the sheave should be controlled.

SIZES OF CAR PLATFORMS FOR FREIGHT AND PASSENGER ELEVATORS

Size of Car				Freight Capacity, Pounds	Passenger Capacity, Pounds
Ft.	In.	Ft.	In.		
3	$3\frac{3}{4}$ x	3	$3\frac{3}{4}$	1,650	700
3	$3\frac{3}{4}$ x	4	10	2,200	1,055
3	$3\frac{3}{4}$ x	6	$6\frac{3}{4}$	3,300	1,760
4	10 x	3	$3\frac{3}{4}$	2,200	1,055
4	10 x	4	10	4,400	2,100
4	10 x	6	$6\frac{3}{4}$	5,500	2,640
4	10 x	9	10	6,600	4,400
6	$6\frac{3}{4}$ x	3	$3\frac{3}{4}$	3,300	1,760
6	$6\frac{3}{4}$ x	4	10	5,500	2,640
6	$6\frac{3}{4}$ x	6	$6\frac{3}{4}$	6,600	3,500
6	$6\frac{3}{4}$ x	9	10	11,000	
9	10 x	4	10	6,600	4,400
9	10 x	6	$6\frac{3}{4}$	11,000	....
9	10 x	9	10	16,500	....
9	10 x	13	$1\frac{1}{2}$	22,000	....
9	10 x	19	$8\frac{1}{4}$	13,000	....
13	$1\frac{1}{2}$ x	9	10	22,000	....
13	$1\frac{1}{2}$ x	13	$1\frac{1}{2}$	22,000	....

Sizes of the machines were determined from the standardized capacities and speeds, and each machine was so constructed that its maximum capacity was a point on the curve of standardization as follows:

Machine	Maximum Speed	Maximum Capacity
A	200 ft. per min. at 1,650 lb.	3,500 lb. at 60 ft. per min.
B	300 ft. per min. at 3,360 lb.	11,000 lb. at 60 ft. per min
C	400 ft. per min. at 5,500 lb.	22,000 lb. at 60 ft. per min.

Only 3 sizes of machines were necessary to cover the full range of capacities and speeds. This compares favorably with American practice, as it is usual for American firms to use up to six machines with a maximum capacity of 12,000 pounds.

With the standards and the answers to but four questions we are able to proceed with the manufacture of an elevator. The questions are:

1. What is to be carried by the elevator?
2. What is the approximate size of the car?
3. What is the current supply?
4. What is the travel and number of floors?

It is obvious that a great step forward has been made in this work. Should any readers be interested in the details of the plan the writer will be glad to furnish them.

▼

A SURVEY made by the Corrosion Subcommittee of the National District Heating Association indicates that steam supplied by district steam companies to its customers may contain from 0.4 to 1.0 c.c. of oxygen per liter if no deaërating feed-water heater is used. If an efficient deaërating heater is used the oxygen concentration will be from 0.02 to 0.05 c.c. per liter. The condensation drained from the heating system in many cases contains as much as 2.0 to 4.0 c.c. of oxygen per liter.

Measuring Temperatures in Rotating Machinery

The advantages and disadvantages of several methods of measuring temperatures in rotating machines are given and a temperature meter operating on a small transformer and copper-oxide rectifier is described. The latter allows grounding one terminal of the temperature-detector coils without the film cutouts used previously

By H. E. PEARSON

Switchgear Department
General Electric Company

ABOVE certain critical temperatures, depending upon the materials, carbonization of insulation takes place rapidly and reduces its useful life. It is the function of temperature-meter equipments to safeguard large and expensive units' operation by indicating internal temperature conditions. The value of such equipments depends largely upon the methods used and the ease and accuracy with which the temperature can be obtained. Another important factor is the protection of the operator and equipment from dangerous potentials that might exist in the meter circuit due to breakdown of armature-coil insulation and to other causes.

Various methods can be used to measure temperatures, such as thermometers, increase in resistance of machine windings, thermocouples and resistance-detector coils. Resistance-detector coils have been found the most satisfactory and are the generally accepted standard.

Thermometers applied to a machine's surface are not satisfactory. Internal parts of electrical machinery get much hotter than shown by thermometer indications. The actual conditions cannot be inferred from such readings because of the time lag, especially on rapid changes in load.

Measurement obtained by increased resistance of machine windings is open to criticism. There is a considerable temperature drop between the hottest parts of a winding near the center of a machine and the more exposed parts at the ends. Consequently the measurement would represent the average, not the highest, temperature, and would have little value unless the internal temperature drops were known. The resistance of armature windings is very low, and unless great care is taken the temperature values would not be satisfactory. However, reliable field-winding temperatures can be obtained in this manner, because they have a relatively high resistance.

Thermocouples have the disadvantage that the temperature obtained is determined at a remote point rather than at the thermocouple's junction. Not only is the meter reading affected by the resistance of the leads, but its accuracy is influenced by temperature changes at the cold junction. A meter constructed on this principle must be compensated for such changes. Another disadvantage is that thermocouples produce a small voltage at ordinary temperatures. Therefore they generally require potentiometer methods of measurement, with their concomitant problems of balancing, adjusting and checking. For this reason they find their chief use in connection with pyrometers, where the difference in temperature between the hot and cold junctions is high.

When determining temperature by resistance temperature detectors embedded in the machine windings very simple means can be employed. For instance, the resistance may be obtained by comparing the drop across the detector coil with that across a standard coil of negligible temperature coefficient, or by any of the well-known bridge methods. In either case the result is the actual temperature at the place of the detector coil rather than the difference between this place and some other point, as, for example, where the cold junction of a thermocouple is located. Since an error of 0.4 per cent in the resistance results in an error of 1 deg. C. in temperature, the more simple and direct the methods of measurement the more satisfactory will be the results. A differential instrument of the D'Arsonval type, using the drop comparison method just outlined, has been successfully used for a number of years. Such a meter is direct-reading and affords a simple and convenient means for accurate temperature measurement at the switchboard.

It is essential that the method employed affords safety both to operators and equipment. Standard practice is to use a disk-film, cutout-type protective device mounted on one side of the machine. One film cutout is provided for each detector coil to which one side of the cutout is connected, the other side being connected to a grounding strip. Such a device permits the direct-current temperature meter to be safely operated from control or exciter buses without grounding them. If a dangerous potential is given to any of the detector coils through a failure of armature insulation or by an accumulation of static charges, the film cutout breaks down and brings the

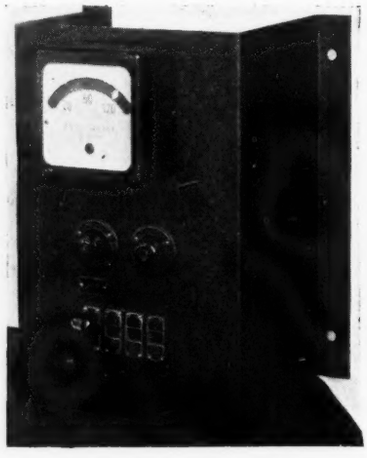


Fig. 1—Temperature meter with its transfer plugs and receptacles, that operates on a rectified alternating current

detector coils involved to ground potential. The dielectric strength of the insulating film is such that the puncture voltage (about 400 volts) is well below that considered safe for the indicating instruments and operator.

Experience shows that the film cutouts seldom have to function because of high voltage due to a breakdown in machine insulation, except in cases involving the destruction of the windings. Trouble has been experienced, however, in transitory voltages puncturing the film cutouts. It is still a matter of conjecture whether such overvoltages are caused by sudden rises on the operating bus aboveground when a heavy solenoid is operated, or whether they are static charges due to the proximity of

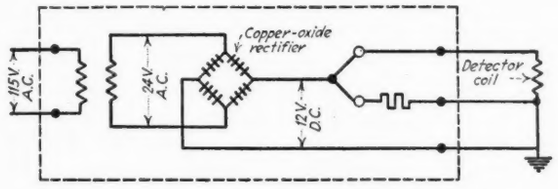


Fig. 2—Diagram of temperature-meter circuits

the high-voltage generator windings. Whatever the cause, the resulting ground is objectionable if the source is a direct-current control or exciter bus. This led to consideration of using an independent direct-current source for temperature meters which could be grounded, and thus eliminate the need for film cutouts. This subject has been under discussion for several years by the N.E.L.A. and N.E.M.A., with the result that both of these bodies have recently adopted new rulings. The N.E.M.A. Rule SG4-60, "Resistance Temperature Detectors for Rotating Apparatus," reads:

> *(a)* Where resistance-type temperature detectors are used, an independent source of direct-current energy supply for measuring instruments, such as a battery, shall be used. This may take the form of dry cells or a storage battery.
>
> *(b)* One lead of each temperature detector is to be solidly connected to ground, thus providing a reliable drainage path for static charges. This ground connection shall be made as near to the machine as possible, preferably at the terminal box by the machine frame.
>
> *(c)* Film cutouts are not necessary in view of the static drainage provided by the grounding of one detector lead.

In one type of temperature meter now available, Fig. 1, the protective device is eliminated and the detector coils are solidly connected to ground in accordance with the above ruling, but the expense of maintaining a separate battery is avoided by the use of a rectified alternating current.

The development of this instrument was initiated in two steps. The first involved the design of a crossed arrangement of differential armature windings of a D'Arsonval instrument with a special polepiece construction. One of the windings is in series with a coil of Manganin, having a resistance equal to that of the temperature detector, usually at 80 deg. C., and the other winding is in series with the detector coil. When the temperature of the detector coil rises its resistance increases, while the resistance of the Manganin coil remains practically constant. The current in the detector branch of the circuit therefore decreases, causing a corresponding deflection toward a high-temperature marking on the scale of the meter. The reverse occurs when the temperature of the detector coil decreases. An advantage of this type of instrument is that it is practically independent of voltage variation, due to the construction of the two windings and the polepiece. A variation as wide as 25 per cent above or below normal voltage is permissible and does not affect the guaranteed instrument accuracy.

The second step in its development was to make the device suitable for operation on a 115-volt, alternating-current source by means of a rectifier. A small potential transformer rated 115 to 24 volts is connected to a copper-oxide rectifier supplying 12 volts direct-current to the operating circuit. The copper-oxide rectifier unit is connected in a Nodon-valve arrangement to give full-wave rectification. There is approximately 50 per cent loss in voltage between the alternating-current and direct-current side. Fig. 2 is a diagram of the meter circuit. The potential transformer and rectifier unit were designed small enough to mount inside the instrument case, making it self-contained and requiring no external equipment other than the usual transfer plug and receptacles and the test resistor. Any 115-volt alternating-current supply circuit can be used to operate the meter.

With this meter the detector coils in the machine are grounded at the machine terminal board, eliminating the film cutouts. One side of the operating circuit may be made common between the switchboard and machine terminal board, thereby reducing the number of leads required. A typical wiring diagram is shown in Fig. 3. The instrument gives a direct reading and can give a continuous indication of temperature to any detector coil

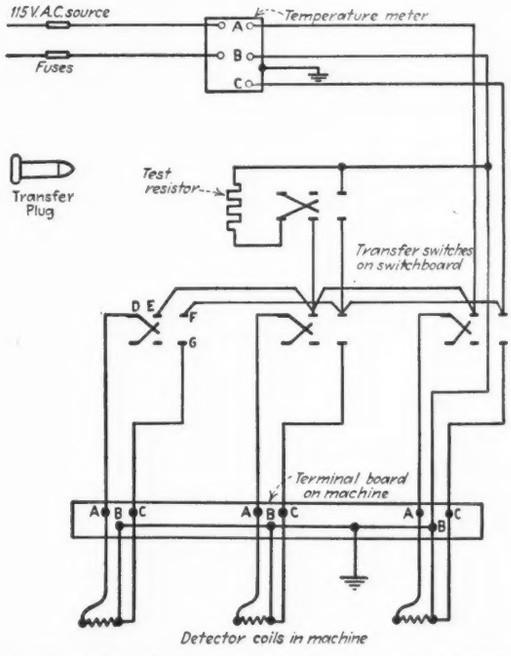


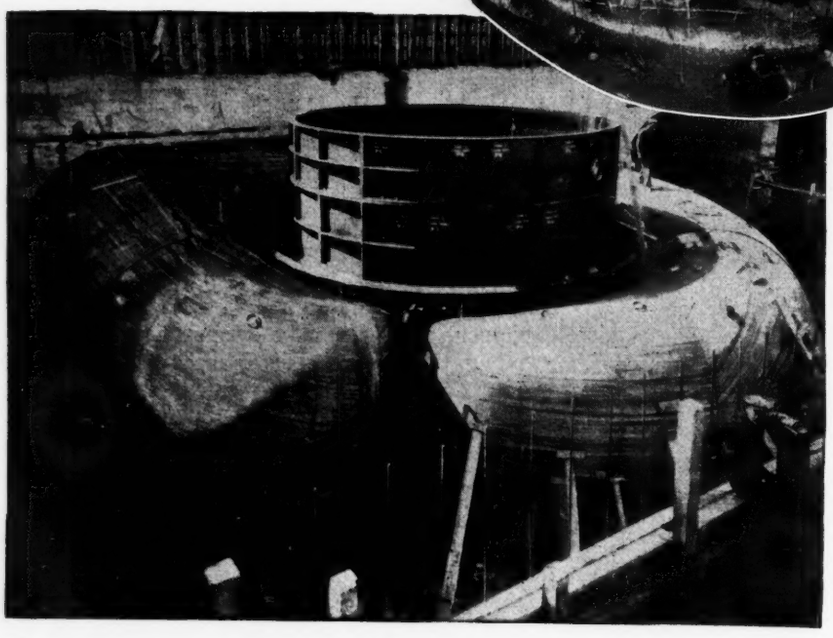
Fig. 3—Wiring diagram of a temperature meter connected to detector coils in a machine's windings

to which it is connected, without requiring adjustment. A compact arrangement and method of mounting a complete equipment away from the switchboard is provided with five plug-type receptacles, four for connection to each of four detector coils, and the fifth for connection to a test resistor. The test resistor is furnished as standard equipment and provides an easy check on the meter. Safety-type fusible cutouts, removable from the front, are generally furnished when it would be inconvenient to reach the back of the panel. The leads are brought up from the floor through the pedestal leg. In Fig. 1 a similar equipment for three detector coils is shown on a panel suitable for wall mounting.

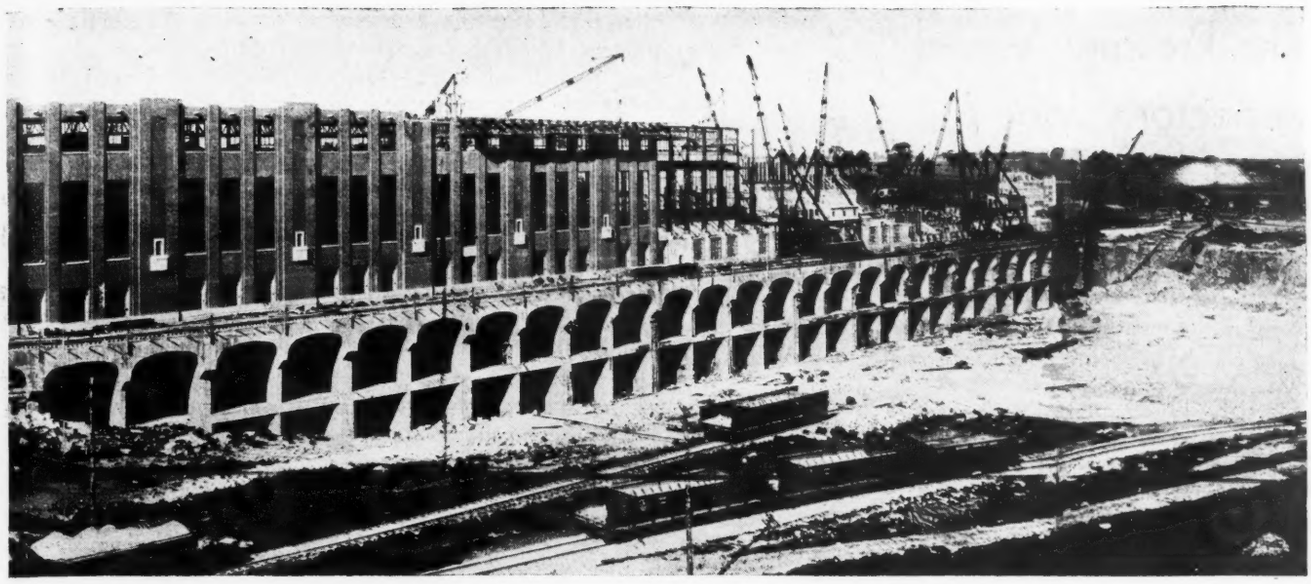
BEAUHARNOIS DEVELOPMENT PROGRESSING RAPIDLY

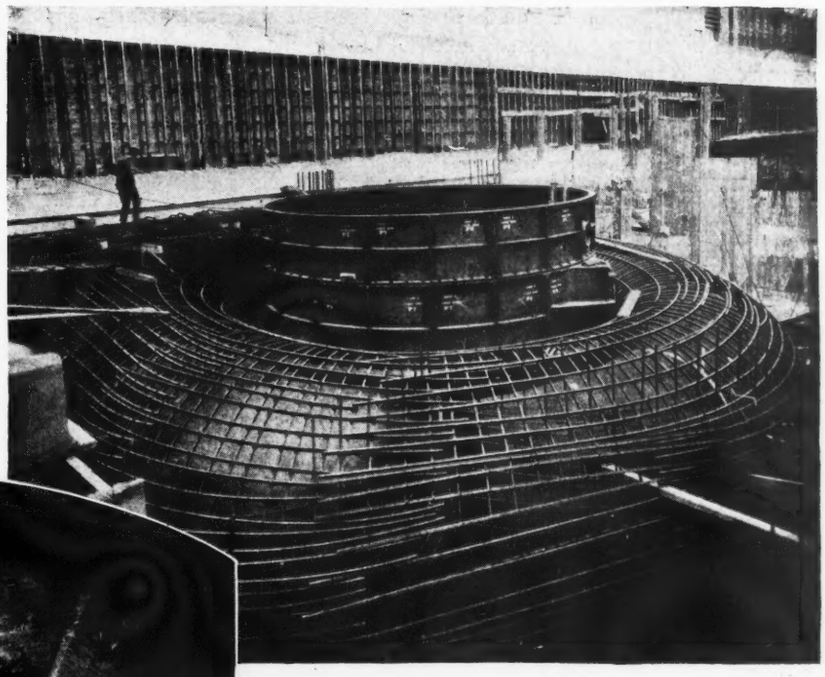
Right—Power house of Beauharnois Power Corporation, on the St. Lawrence River, near Montreal, as it looked on July 17. The initial installation in this plant is over 500,000 horsepower

Above—Speed ring, for one of the 50,000-hp. turbines, being assembled around the top of the draft tube. The guide vanes in the speed ring are cast separately and are welded to the top and bottom rings in the shop

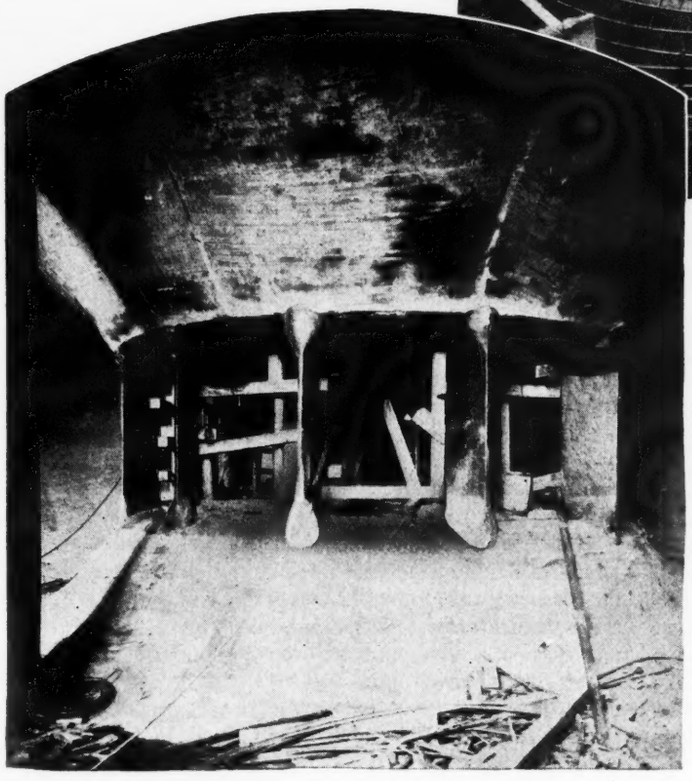


Left—Wood form for the concrete scroll case in place around one of the speed rings. This scroll case leads in two directions around the speed ring instead of one, as is usual practice





Below—Inside the scroll case for one of the ten 50,000-hp. main units, looking toward the intakes between the guide vanes in the speed ring. The effective head on the plant is about 80 ft. In addition to the ten main units there are two 8,000-hp. service machines



Above—Steel reinforcing bars in place around the form for one of the scroll cases. A massive concrete block will be poured around the scroll-case form as part of the plant's substructure. The penstocks and scroll cases are formed in the plant's concrete structure

The Pressure Vessel Inspector's Job

By E. R. FISH
Chief Engineer
Hartford Steam Boiler Inspection & Insurance Co.

The boiler inspector, though frequently much berated, works in the interest of both builder and user, and, as this article shows, helps to enhance mutual cooperation

INSPECTION of pressure vessels by disinterested parties is for the purpose of assuring those interested (1) that the design is correct, (2) that the material and workmanship are according to specifications, and (3) that when in service the safety of the structure is maintained. It is evident from the foregoing that inspection is divided into two general classes, shop inspection and field inspection, each involving the exercise of quite different phases of inquisitiveness and attention.

All pressure vessels are built to some kind of specification, although often very sketchy. It is the shop inspector's responsibility that those specifications are substantially complied with—substantially because it is physically impossible and economically unnecessary that there shall be no departures from the exact letter of the several dimensions, etc. It is likewise impracticable to set up tolerances that shall say, in effect, "thus far you may go, but no further." The point to be kept in mind is whether the small departures will prejudice the safety or life of the structure.

If only experienced inspectors are employed, and none others should be, their judgment can be depended on to prevent tolerances larger than are proper. If in doubt they should adopt a reasonably conservative attitude. Most manufacturers want to turn out good work, but there is always the tendency of the shop men to hide and minimize the inevitable slips that occur. On the other hand, there is undoubtedly a class of shops that do not hesitate to put out as cheap and inferior a product as they can without discovery. It is the inspector's job to find these shortcomings and insist on their rectification to the extent the circumstances warrant. All serious variations from the specifications and drawings should be brought to the attention of the higher shop officials, and, if deemed sufficiently serious, to the attention also of the purchaser's representative, for adjudication; although if any such variation is sufficiently serious, in the inspector's judgment, to affect the safety or operation of the vessel it should be condemned.

Rejections because of departures that are merely technical are to be avoided. However, after completion, the inspector's certification in the shape of a signed paper or stampings applied to the structure should carry the undoubted assurance that it is substantially in compliance with the terms under which it was purchased. It should be a matter of pride on the part of the inspector that these final formalities testify to the conscientious fulfillment of his responsibilities.

The inspection of vessels in service is to discover weaknesses that may develop with the lapse of time, and to see that such protective devices as are necessary for their safe operation are in place and in operative condition. The first of these functions requires painstaking examination of all the myriad parts that may be affected by pressure, temperature or other deteriorating influences and the changes these factors produce over long periods of time. Many of these effects can be entirely hidden, so that it is only by an extended knowledge, born of experience, that the inspector judges the condition and foresees the need for uncovering and possible partial dismemberment in order to satisfy himself concerning the actual conditions. Innumerable serious weaknesses, such as cracked or corroded plates, have thus been discovered, many times only after persistent insistence that the investigation be made. Not infrequently it is difficult to persuade the one in charge to guard his own interests. Here let it be again mentioned and emphasized that cracks and corrosion are two of the most serious causes of pressure vessel failures.

The second function of the field inspector concerns the maintenance in operating condition of the protective devices, all of which should be carefully and continually watched. A gage that indicates erroneously gives a false sense of security, and other devices on which dependence is placed for safe operation must, by constant supervision, be prevented from failing to operate properly. It is the inspector's duty to examine all such, and assure himself that they are correct and in condition for continued effective functioning. Relief valves that, through long disuse and neglect to test periodically, have become stuck and have therefore failed to operate at the crucial moment have caused very many serious accidents. In addition there are often many arrangements of pipe connections and other equipment that when not properly made may cause loss of life or serious personal injuries. The inspector's responsibilities cover all these.

Coming in contact with a great variety of plants and conditions an observant inspector can make recommendations for changes that in many instances will improve both safety and operation. Service of this sort reacts on those with whom the inspector comes in contact, to increase their confidence in his judgment.

Inspector Must Enforce Law

Laws governing the construction, installation and equipment of boilers are in effect in many localities, and in a few places, the number of which is growing rapidly, pressure vessels of other kinds are covered. The inspector must see that the law is complied with. Theoretically it is necessary that the legal provisions be literally enforced. But here again the rule of reason should apply and the principle of substantial compliance should be applied. There are often conditions that justify some departures from the letter of the law which in no wise jeopardize either the safety of the structure or of the attendants. If the spirit of the law is observed the desired end is attained and should not be objected to if the insistence involves unnecessary loss or hardship. However, the inspector must comment on all violations, great or small, with recommendations for leniency.

To sum up the problem briefly let us say that, as the one who stands between the buyer and seller as regards new work, the inspector must see that justice is done to each; that the seller supplies substantially what he has contracted to sell and that the buyer does not demand unreasonable compliance with the letter of the specifications. Also, it is his duty, as regards apparatus in service, not to omit any effort to uncover defects that have developed or may be in process of developing and to insist on the proper maintenance of protective equipment. All of which is to the end that safety and durability will be maintained.

...RIGHT OUT OF THE PLANT...

Connecting Two Motors to Drive the Same Load

IN A ROCK-CRUSHING PLANT where a larger crusher had replaced a smaller one it was found that the motor was overloaded. It was decided to use a spare motor that was on hand to help the other drive the crusher. The crusher was driven by a 150-hp., 900-r.p.m., three-phase motor through a countershaft. Test showed that this motor was overloaded 25 per cent a greater part of the time. The spare motor was rated at 50 hp., 900 r.p.m., three phases. A shaft extension was added to the larger motor by using a solid coupling and an outboard bearing. A 12-in. pulley was placed on the 50-hp. motor's shaft, and the same size on the shaft extension of the 150-hp. motor.

After starting it was found that the small motor was running at nearly the same temperature as was the large one before the change was made. A wattmeter test showed that the 50-hp. motor was overloaded 12 per cent. The 12-in. pulley on the 50-hp. motor was then replaced by one 11.5 in. in diameter.

Tests were then made and both machines were found to be operating normally with a decrease in temperature and line current. Satisfactory results followed until the close of the plant several months later.

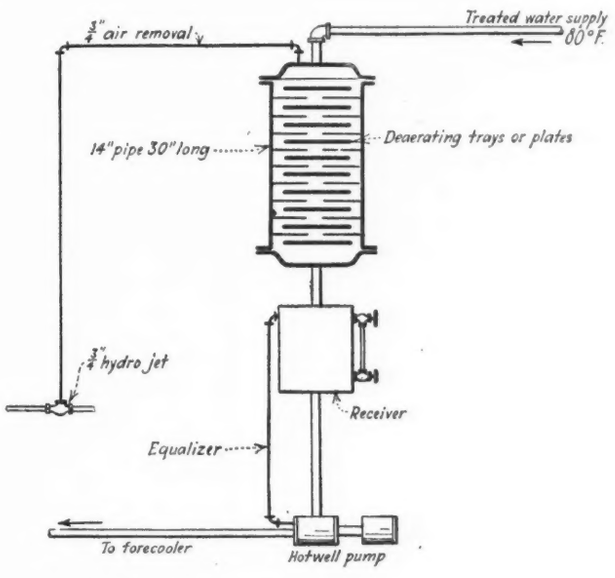
Seattle, Wash. RALPH E. MACKAY.

"Why Air Agitation in Ice Cans?"

I HAVE FOLLOWED the discussions on the subject of air agitation in ice cans with a good deal of interest, and I should like to add to the comments that have already appeared.

In regard to odors and other impurities, these can easily be removed. About eight years ago I made raw-water ice by deaërating water which had been previously softened in a batch water softener. The accompanying illustration shows the method and equipment used. Contrary to power plant deaëration practice, it is unnecessary to have the "heat drop effect." City water, after treating with lime in a batch water softener and at prevailing atmospheric temperature, was put through the deaërating equipment, frozen and sold in competition with distilled-water and raw-water ice. This apparatus made 15 tons a day, and the cost of equipment was about that of air-washer equipment on the present high-pressure air-agitation systems. The vacuum was maintained by a ¾-in. jet operated from the discharge of the circulating-water pump. I believe there are many waters throughout the country which will make clear ice without air agitation by the above process. For extremely bad water, the ice would be "white," but it would not have objectionable odors.

But why beat around the bush? The real reason that the industry cannot make "white ice" is that it invites competition. To make artificial ice, it was necessary to compete with natural clear ice. This was accomplished by distilled water. The re-boiler played no small part in making clear ice. When raw-water ice was contemplated it was necessary to make it clear in order to



Equipment used for deaërating water for ice manufacture

compete with distilled-water ice. Do not think for a moment that the household refrigerator machine manufacturer would not make clear ice if a practicable method were devised. One of the strongholds of the ice industry is clear ice. F. C. WAGNER.

Corpus Christi, Texas.

WITHOUT attempting to go into the history—past, present or future—of raw-water ice manufacture, I should like to state that air never was, is not now, nor ever will be, introduced into the water in an ice can for the purpose of sanitation in conjunction with the making of a block of ice from "raw (so-called) water."

Of course, the user's definition of "sanitary" must be given consideration, and if by "sanitary" he refers to the white or opaque appearance that practically all natural waters give to a block of ice when frozen without agitation, then my statement is not relevant.

For the numerous methods available and used for

agitation of water at one time or another, in a cell to be frozen into ice, one has but to refer to the records of the Patent Office. Paddles, tilting of the can or rocking from side to side, compressed air, circulating the water in the cell by means of a pump, etc., all will do the trick after a fashion.

Regarding Mr. Schaphorst's observation regarding the "matter in suspension as well as in solution," which when concentrated in the core makes that portion of the block decidedly unsanitary, I should like to state that were it not for the fact that agitation were used there would be no core, so-called, and that the same objectionable features, commonly known as "deposit" or "sludge," which is composed of calcium or magnesium carbonates that deposit out in freezing in exactly the same manner as it does on the heating surface of a boiler, would be deposited in the bottom of the block.

As to whether this would be considered as contributory to an unsanitary condition depends on one's definition of the term. The worst that it does is to necessitate its removal from the ice chamber of the refrigerator in which it happens to be placed, regardless of whether from "core" or "butt" of block. A nuisance and an inconvenience, yes! Unsanitary, or harmful, no! We drink it in soluble form in our daily use of the same water from the city mains that supply the ice company with the water to fill its cans, in nine cases out of ten.

The same thing holds true of the suspended water mentioned by Mr. Schaphorst—except that in about twenty years of contact with the industry I've yet to see the plant that had suspended matter present in its raw water supply that didn't remove it by sand and gravel pressure filters before it reached the cans. Mr. Schaphorst's statement regarding the presence of filth in a block of ice from the operators' shoes surely is not based on fact in any modern ice plant. I suggest that he visit one of the up-to-date plants in his neighborhood for a correct "slant" on what the conditions really are.

Again I state, without fear of contradiction, that the use of air in the manufacture of raw-water ice has no other objective than the thorough agitation of the water to be frozen for the purpose of making a block that is crystal clear in appearance. If by "sanitary" is meant sterile or free from bacteria—most certainly it has nothing within its capacity that will serve. Water from deep wells rarely needs such correction. That from the city mains has already been sterilized. L. E. POLLARD.

Pittsburgh, Pa.

Repairing Loose Bars in Squirrel-Cage Rotors

THE QUESTION in the July 21 number of *Power,* concerning a method of making repairs on induction-motor rotor windings, reminds me of a recent experience. The rotor of a 30-hp., 1,200-r.p.m. motor having cast-on end rings was found to have approximately 30 per cent of the bars broken where they entered the ring, this point being about 1½ in. outside the rotor core. Due to the close spacing of the bars and the likelihood of throwing the rotor out of balance where the joints were welded, the repair was made as follows:

Both end rings were removed from the rotor by cutting all unbroken bars with a hacksaw where they joined the ring. The rings were then chucked in a lathe, and grooves the width of the rotor bars and $\frac{3}{16}$ in. deep were cut in the inside face of each ring, thus removing the imbedded bar ends.

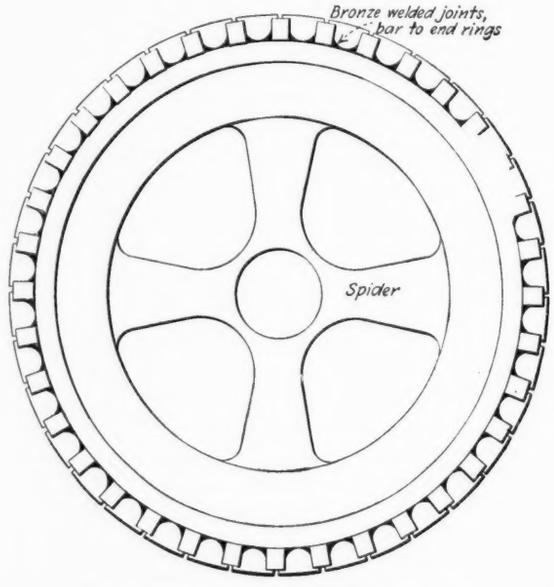
When several bars were replaced that had been burned short the end rings were put on, the bars entering the ring to the bottom of the grooves. The rings were held in this position by a special "C" clamp made to reach across the outside faces of the rings. Small spacer blocks were put between the bars for holding the ring equal distances from the rotor lamination.

The rotor was then placed in a vertical position and a blowtorch was used to preheat the ring. Then with a welding torch the space between the bars was filled even with the top surface of the ring, using "phos-copper" welding rods. This rod is made of copper containing a small percentage of phosphorus.

It is my opinion that if the bars and rings of the rotor are cleaned and the bolts tightened as for soldering and then brazed so as to produce a small fillet around the bars where they overlap the rings the trouble will be eliminated. It would no doubt be best to remove all solder from the joints before welding.

Clewiston, Fla. F. R. MAXWELL.

BOLTED AND SOLDERED or riveted and soldered constructions of squirrel-cage rotor windings have always been a source of trouble to motor users. While these constructions may be satisfactory in the smaller sizes, they have proved just as unsatisfactory in larger ones. Heavy starting and running currents, stalling and overloading are the main contributing factors. These result in vibration, and excessive expansion and contraction of



Rotor bars bronze-welded to the end ring

the end rings and bars, which, in turn, loosens the rivets or bolts, allowing the solder to carry the current. The solder softens and centrifugal force often throws it completely away from the rotor. When this develops the motor may fail to start its load. A permanent repair, which has been done on a number of motors of various voltage and horsepower ratings, is made as follows:

The end rings and bars are removed. If the end ring is in good condition and bent flat, as is the case in some motors, it may be used again. If bent edgewise, with the bars inserted and upset, it will likely be necessary to bend another set of rings of sufficiently heavy stock. The bars are straightened and the solder removed. This is neces-

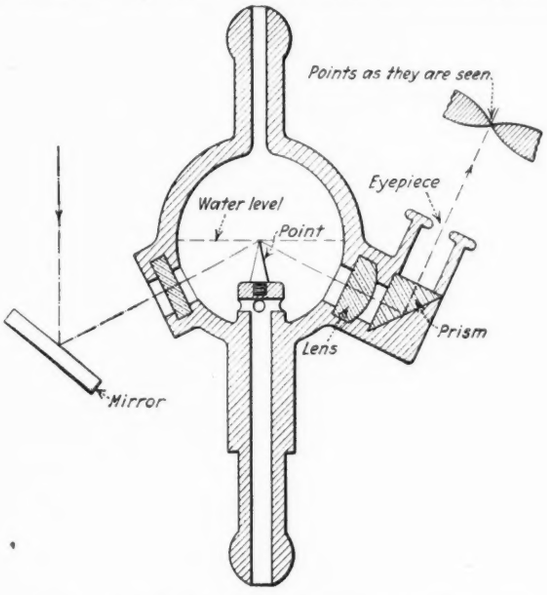
sary, as solder will ruin a copper weld. The bars are re-inserted, the new copper end ring placed beneath them as shown in the figure, and bronze-welded. In this arrangement centrifugal force tends to throw the rings toward the bars. The welds may be made as heavy as desired.

It may be found somewhat difficult at first to bronze-weld copper, but after a little experience a neat and serviceable job can be made and the rotor repaired permanently. Out of a number of repairs made in this manner I have yet to find one giving trouble.

Corpus Christi, Texas. V. A. BRADLEY.

A Precision Water-Level Gage

REFFRRING TO THE water-level gage described on page 749 of the May 12 number, this device could, in my opinion, be simplified by arranging to observe the reflection from the top water surface over the needle point in



Contact of the point with the water is observed from beneath the water surface, using the principle of total reflection

place of the lower water surface [as shown in Fig. 1 and reproduced herewith].

This may be demonstrated by an interesting trial with a sharp needle point in a bowl of water about 6 in. in diameter. The needle may be supported by a cork anchored by an iron washer. After adjusting the water level to just cover the needle, it will be found that a puff of air will carry away enough water to cause the point to raise the water surface. The water level may be restored to cover the point again by one or two drops from a medicine dropper. A little calculation based on the size of the drops and the water surface in the bowl will show that the indication is sensitive to about 1/20,000 in. To estimate the size of the water drops, it is best to weigh a number of them, a hundred or more, the number depending on the weighing facilities.

A good target to use in observing the appearance of the needle point is the bright filament of an incandescent lamp. Looking at the filament by way of its reflection from the water surface over the needle point, it will be found that a minute projection of the needle will split the reflection of the filament. E. M. TINGLEY.

Chicago, Ill.

Employee Advancement by Stepped Wages or Stepped Jobs

IN THE interesting articles on "Stepped Wages or Stepped Jobs" in *Power* of April 28 and July 7 some points are introduced that merit attention. In the original article by Mr. Sorrells it is pointed out that there are two general plans which present themselves in planning a wage-advancement scheme for employees. In the first plan a definite wage is paid for each job and advancement takes place as merited. By the second method no definite wage is fixed for the job, the worker setting his own wage by the value of his work.

In considering systems of payment it must be remembered that the manufacturer has always to remember the price of his product in a competitive market. There is also the basis of the employment of workers—that is, that the employee earn his wages plus a profit to his employer, and neither of these two facts can be ignored. In the first plan there is a unit of measurement as to work and wages; in the second plan there is no defined wage, and the employee must guess as to how much he can earn (and if a new employee as to what may be the state of efficiency of the tools and equipment of the factory).

As a result of the above conditions, which are outside the control of the employees, some of them concentrate wholly upon their own production, believing that with the incentive plan of wage payment in operation they are advancing their own case as to increased wages or promotion.

This is a common error which if not corrected will destroy the harmonious operation of any wage-payment system. It must be explained to the employee that it is his efforts in relation to the system and product as a whole that decide the question of his advancement in wages or position. The employer must also maintain his plant and equipment at a standard of efficiency that will enable the employees to turn out a product of the required quality and quantity with minimum of effort and strain. In other words, "it pays to make the job easily performed."

The cost of the particular incentive system and the amount of clerical work required often helps to decide the choice; the group system as suggested by Mr. Anderson in *Power*, July 7, 1931, certainly reduces the clerical work and lends itself to the harmonious blending of employees. But whatever method of payment is chosen, the aim of the management should always be the same, to encourage the employees to work with, and not for, their employer.

In the cases cited by Mr. Anderson this point is not understood by the employees, and the necessity for correct interpretation of the employer's plans under an incentive method of wage payment is imperative. Where the incentive wage system is installed, with the thorough understanding that there are two sides to the question and mutual good-will is in evidence, the foreman is assisted in fulfilling his proper duties as leader, instructor and interpreter. If these conditions are not realized and understood the foreman becomes a buffer between the employees and the management, thus rendering this effort toward coordination of the various unruly elements most difficult, and also retarding the cooperation which is essential to the success of any incentive method of wage payment. DONALD RAEBURN.

Glasgow, Scotland.

From Among Readers' Problems

Conducted by
L. H. MORRISON

HEATING WITH EXHAUST STEAM—*We are endeavoring to estimate whether the exhaust from a 750-lb. back-pressure turbine will be sufficient to supply steam to our heating system. What will be the approximate steam consumption of a unit of this size if operated with steam at 150 lb. pressure, 100 deg. superheat against a back pressure of 10 lb. gage?* E.C.A.

The total heat in a pound of steam at 150 lb. pressure (165 lb. abs.) and 100 deg. superheat as found on a Mollier diagram is 1,252 B.t.u. After adiabatic expansion through the turbine to 10 lb. back pressure (25 lb. abs.) the steam has a total heat of 1,099 B.t.u. The heat available to the turbine for transforming into work is the difference between the two total heats, or 153 B.t.u. The heat equivalent of a kilowatt-hour is 3,412 B.t.u. and the theoretical steam rate is 3,412 ÷ 153 = 22.3 lb. of steam per hour. The over-all efficiency of a turbine of this capacity will be in the neighborhood of 63 per cent, and the actual steam rate is then 22.3 ÷ 63 = 35.4 pounds. Of course, the steam consumption will vary with the turbine efficiency, which is influenced by the type and speed of the unit.

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NOISE FROM SLAPPING OF PISTON RINGS—*We have a pair of hoisting engines 24x42 in., using steam at 150 lb. gage, superheated 100 deg. F. Each piston has a bull ring 7 in. wide and snap rings which are set out by adjustable half-moon springs. The engines run very quietly under full steam and load, but while coasting at fairly high speed there is a slap or pound that seems to come from the pistons. What causes the noise?* A.J.M.

If the noise proceeds from the pistons, it undoubtedly is caused by side play of the rings and sudden change of cylinder pressure from one side of the pistons to the other. It would be difficult to predict just what variations of pressure occur during coasting without knowing the valve setting and assuming that the valves are absolutely tight, which is hardly to be expected. Indicator diagrams taken during coasting would reveal the distribution of cylinder pressure during the stroke and demonstrate whether there is a sudden change of pressure from one side to the other of the pistons. If the trouble seems to be due to side play of the piston rings, the construction will suggest how a closer fit can be obtained.

ELIMINATING OIL VAPOR FROM STEAM TURBINE BEARINGS — *We are having trouble with oil vapor from our turbine bearings being drawn into the generator. Can this be overcome?* L.C.K.

This trouble can be obviated in many cases by the use of circular felt washers secured to the end of the bearing and by reducing the oil flow to a minimum. A more effective method is to cut a circular groove ½ in. wide about ¼ in. from the end of the bearing. In the top half this groove should extend all the way around, while in the bottom half it should stop above 1 in. from the center face and end in a ½-in. hole drilled through the bearing shell. This block in the groove prevents the oil making a complete circuit and what oil is carried along is discharged through the ½-in. hole.

In both halves five or six $\frac{7}{16}$-in. holes should be drilled from the groove radially outward through the bearing to serve as a vent for the oil and vapor. This groove prevents the surplus oil from being discharged from the end of the bearing. It is necessary to make this alteration only on the outer end of the bearing nearest the generator.

PREVIOUS QUESTION DISCUSSED BY READERS

THE QUESTION

TO IMPROVE the economy of our boiler room we are installing economizers that are designed to reduce the flue gas temperature from 600 to 350 deg. The economizer is guaranteed to have a draft loss of not over 1 in. at maximum rating. Assuming the same rate of combustion, will our old induced-draft fan have sufficient capacity to handle the cooler flue gas and increased resistance? The fan has a capacity of 50,000 c.f.m. at 600 deg., 3 in. pressure and 600 r.p.m. It is driven by a 40-hp. direct-current motor. What changes to motor are necessary?

ALL OF THE ELEMENTS necessary to an exact answer are not given, but from the conditions stated it is my opinion that no motor changes will be required. The fan is now rated 50,000 c.f.m. at 600 deg., 3 in. pressure and 600 r.p.m. The air horsepower is therefore

$$\frac{50{,}000 \times 3}{6355} = 23.6$$

Using a 40-hp. motor, the static fan efficiency is 59 per cent. From this I conclude that the fan is working well out on the dropping part of its characteristic pressure-volume curve.

Since the same weight of flue gas is to be handled after the economizer is installed, the new volume can be calculated as follows:

$$\frac{460 + 350}{460 + 600} \times 50{,}000 = 38{,}200 \text{ c.f.m.}$$

The new pressure condition is 4 in. static, making the new air horsepower

$$\frac{38{,}200 \times 4}{6{,}355} = 24, \text{ and}$$

the motor will have the same work to do.

The 600 r.p.m. may be wrong for the new conditions. To answer this exactly requires use of the characteristic curve for this particular fan. At 50,000 c.f.m., 600 r.p.m. and 350 deg. the static pressure developed by the fan would be

$$\frac{(460 + 600)}{(460 + 350)} \times 3 \text{ in.} = 3.92 \text{ in.}$$

As only 38,200 c.f.m. must be handled at 350 deg., the corresponding pressure will be more than 3.92 in., probably between 4½ to 5 in., depending on the pressure-volume curve of this specific fan. Therefore a decrease in fan speed is indicated, probably 525 to 550 r.p.m.

If the present motor is a variable-speed machine the answer is evident. If it is a belted motor the pulley can easily be corrected. If it is a fixed-speed direct-connected motor, I doubt if any change is justified other than throttling the stack damper a little.

R. E. CRAMER.
Pittsburgh, Pa.

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THE PERFORMANCE of a fan under changed conditions of operation cannot be predicted with any degree of exactness unless the characteristics of the

fan are obtained from the manufacturer. In this case it would seem that there is a fair possibility that the fan may be found to operate satisfactorily under the new conditions imposed by the economizer.

Delivery of 50,000 cu.ft. of gas per minute against a pressure of 3 in. requires 23.6 air-horsepower. The same weight of gas per minute at a temperature of 350 deg. would have a volume of 38,200 cu.ft., and with a pressure of 4 in. would require 24.1 air-horsepower. If the fan was originally of proper capacity and type for the installation, its efficiency should have been about 60 per cent. This would require 39.4 hp. at the motor for full-capacity operation. Under the new conditions the efficiency will probably be reduced 2 or 3 per cent. Assuming 57 per cent efficiency, the power required to drive the fan will be 42.3 hp. This should not be an excessive load for the 40-hp. motor.

It is possible that the speed of the fan will need to be changed somewhat to meet the new conditions of operation. Without knowing the type of fan it is impossible to state whether the speed should be raised or lowered. In either case, however, the change in speed should not amount to over 10 per cent, and since a direct-current motor is being used this can be obtained without undue difficulty.

P. A. Willis.

Washington, D. C.

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The operation of the fans after the new economizers are installed will be governed by friction losses from boiler outlet to the stack discharge to atmosphere.

The change in temperature of the gas from 600 to 350 deg. F. will decrease its specific volume and reduce the velocity through the duct. The friction in the existing ducts which are being replaced varies as the square of the velocity and may be reduced by the new installation, depending upon the layout. If the stack has considerable height the loss in draft which would occur from the decrease in temperature would place additional load on the fan. While the manufacturer guarantees the loss through the economizer to be 1 in., it may be somewhat smaller in actual operation.

Unless the fan is of an unusual type, when operated with the present motor, the volume handled being decreased, the static pressure will increase until a condition of equilibrium is reached to meet the fan characteristics for that speed. As only one point of operation is given, it is impossible to state definitely what the static pressure will be. If the manufacturer of the fan can be reached a new curve can easily be obtained for the new temperature. This would indicate whether the present motor is large enough. In the event it is found that a larger motor is needed the fan manufacturer should be consulted to see whether the present shaft is strong enough for a larger motor.

Before the purchase of new motors an actual test could be made on a boiler. The electrical input to the motors could be metered to determine when the maximum motor capacity has been reached. After this it could be determined whether there is any necessity for alteration to the fans or motors.

H. A. Goss.

Chicago, Ill.

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This problem can best be answered by referring to the curves of the fan in question; but in all probability the fan will operate at approximately the same speed and horsepower for the changed conditions, that is, when using the economizer as for the old conditions. This was often shown to my satisfaction when calculating fans in conjunction with air preheaters. It was practically always found that the fan would require the same speed and horsepower whether or not an air preheater was used. The same will, of course, apply to economizers. Advantage was taken of this in planning an existing power plant for a large industrial which, at the time the changes were made, did not have sufficient load to warrant installing the preheaters, but expected to justify them in the near future when the load increased. Space was left between the boiler outlet and the induced fan inlet for the preheaters. The fans will operate the same as they do now when the preheaters are installed.

H. L. Parry.

New York, N. Y.

A Question for Our Readers

WE HAVE an air compressor driven by a 125-hp., 700-r.p.m. motor through a 16-in. double leather belt. The motor pulley is 16 in. and the flywheel on the compressor 88 in. in diameter. There is an idler on the belt about half way between the pullies, which run on 9-ft. centers. Trouble has been experienced with the belt slipping, and tightening it with the idler does not entirely eliminate the slipping. What is the best place to locate the idler to prevent slipping of the belt? D. J.

Suitable answers, if received promptly, will be paid for[1] when published

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Under the new conditions of operation the volume, temperature, static pressure, revolutions per minute and horsepower differ from that existing under the original conditions of operation. Consequently there are too many variables introduced to obtain a satisfactory solution by means of formulas or fan laws. It would be necessary to obtain from the fan manufacturer a catalog giving the rating in volume of air handled, revolutions per minute, horsepower, and static pressure for this particular fan, and proceed as follows:

The weight of air in pounds per minute handled will be the same in each case, so that converting the 50,000 c.f.m. originally handled into pounds per minute by dividing by 26.66, which is the number of cubic feet of air in one pound, at 600 deg., we obtain the weight of 1,875 lb. per minute handled under the old conditions. This reconverted into cubic feet of air per minute at 350 deg. by multiplying by 20.38 cu.ft. per pound at this temperature gives us a new volume of air to be handled of 38,200 c.f.m. at 4 in. static pressure, and 350 degrees.

The only thing left to determine is the revolutions per minute and horsepower required for these conditions.

At a temperature of 350 deg. the factor 1.235 gives the ratio between the fan speed necessary for the temperature of 350 deg. and a temperature of 70 deg. to produce the same water gage indication. In other words, the velocity constant for 350 deg. gas is 4,951 ft. per minute, and for 70 deg. gas is 4,006 ft. per minute, the ratio between these two being 1.235.

The volume of 38,200 should now be divided by 1.235, which gives a volume of 31,000 c.f.m. at 70 deg. The revolutions per minute and horsepower found from the catalog opposite the reading of 31,000 c.f.m. and 4 in. static pressure should be multiplied by the factor 1.235, which will give the corrected revolutions per minute and horsepower necessary to handle the desired volume of air, 38,200 c.f.m. at 4 in. static pressure. This is, of course, based on the assumption that the catalog ratings are based on standard air at 70 deg., which is usually the case.

For comparison, a No. 7 single-inlet, single-width Sirocco fan complies almost exactly with the original specification, assuming the motor is operating at full load. Using the above method of calculations of the new condition, and using the manufacturer's catalog rating, this No. 7 fan would have to operate at 582 r.p.m., requiring 37 brake-horsepower to handle 38,200 c.f.m. of 350 deg. air against a resistance of 4 in. pressure. Assuming that the fan which is installed will have similar characteristics, it would appear that the same motor operating at the same speed could be used.

If such is the case, no changes in the motor will be necessary, although it is not stated whether the present motor is belt-driven or direct-connected.

Harold H. Hill.

Atlanta, Ga.

[1] As an alternative to cash payment for answers published, readers may select any one of the following books. (Be sure to state the book desired.):

Morrison's *American Diesel Engines*; Walker and Crocker's *Piping Handbook*; Norris and Therkeisen's *Heat Power*; Emswiler's *Thermodynamics*; Church's *Steam Turbines*; Uehling's *Heat Loss Analysis*; Croft's *Steam Power Plant Auxiliaries and Accessories*; Powell's *Boiler Feed Water Purification*; Osborne's *Power Plant Lubrication*; Moyer and Fritz' *Refrigeration*; Rietschel-Brabbee's *Heating and Ventilation*; Annett's *Electric Elevators*.

Good Results Claimed for Water-Expansion Engine

A new type of engine, operated by the expansion and contraction of liquid water, has been developed in England. Reported results indicate a possible field for the new prime mover on ships, locomotives, and possibly for stationary use.

THE IDEA of operating a reciprocating engine commercially by the expansion and contraction of liquid water will seem rather fantastic to most American engineers. Yet an entire meeting of the Royal Society of Arts, London, was recently given over to a serious discussion of this engine. Data there presented by J. F. J. Malone, covering both theory and extensive operating tests, demanded consideration for this new prime mover, which uses the principle of the old hot-air engine, but with a fluid of very different characteristics.

Diagrammatically, the entire apparatus is shown in Fig. 1. At the bottom is the so-called "TD tube and TD pile," to be discussed later, At the top, connected by a tube, is the working cylinder. Since working pressures amount to several tons per square inch, the diameter of the ram is necessarily small. Throughout operation the water in the engine cylinder, and in the connecting tube, remains cold.

The heart of this machine is the reciprocating "TD pile," which slides back and forth within the "TD tube," driven by an eccentric set 90 deg. ahead of the main crank on the same shaft. (In these expressions "TD" stands for thermodynamic.)

At the two ends of the TD pile are dummies, that at the right being constantly hot and that the left constantly cold. Both are provided with such clearance that water can pass freely around them. Two sets of tubes carry the water from one end of the TD pile to the other when it is moved. Each set is provided with a check valve so that water flows from one end of the TD pile to the other through one set of tubes, and in the reverse direction through the other set of tubes.

The TD pile is constantly heated by a furnace at the right, and cooled by cooling water at the left.

The result of moving the TD pile to the right is to displace all the water through it to the left, and make the water cold. Conversely, the effect of moving the TD pile to the left is to displace all the water to the right, and make it all hot. With these movements the total volume of water in the system is increased or decreased.

To put it another way, remembering that water is elastic, with a given volume the movement of the thermodynamic pile to the left will increase the pressure on the engine piston. Its movement to the right, cooling part of the water, will decrease the pressure. In the operation of the engine volume and temperature are changed independently so that pressure is the net result.

The ideal cycle for a heat engine requires all the heat to be admitted at the highest temperature and delivered at

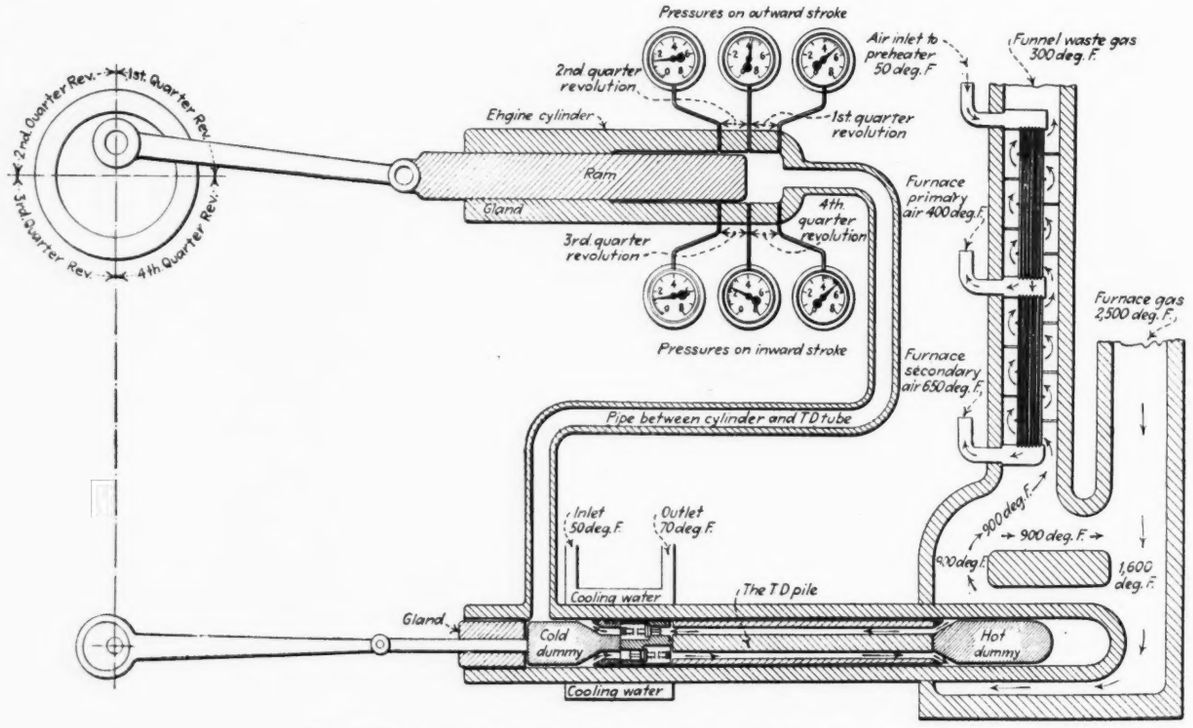
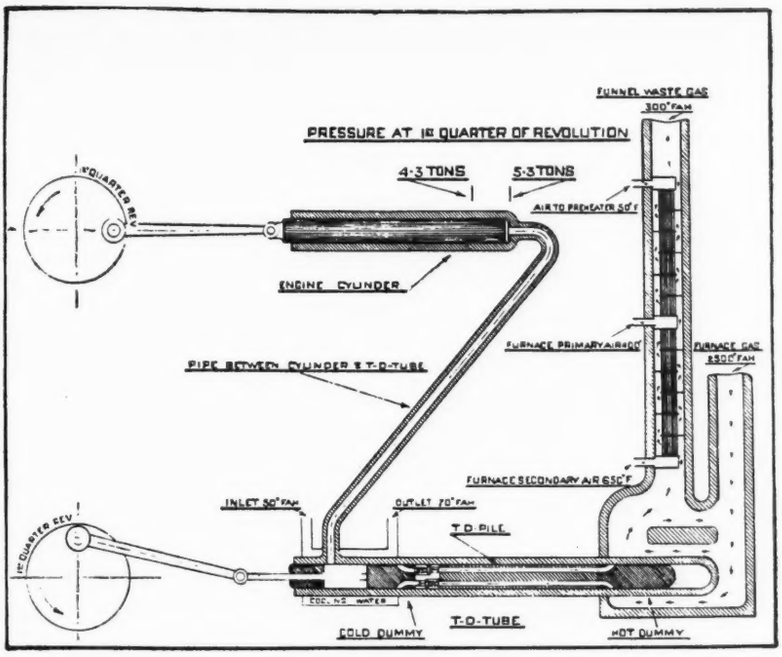
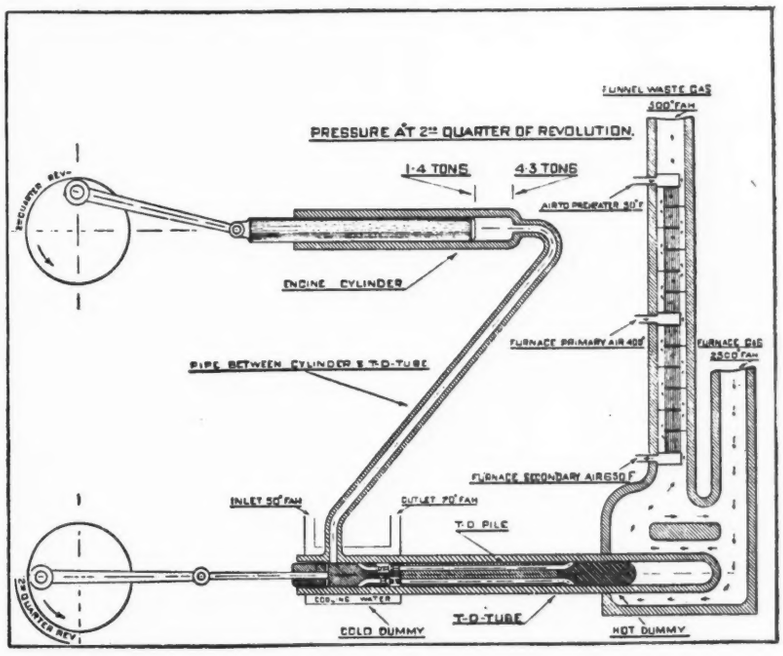


Fig. 1—Reciprocation of the "TD pile" alternately heats and cools water in lower cylinder, thereby producing the forces that operate the engine. Sketch is purely diagrammatic



Figs. 2 and 3 (also 4 and 5 on next page) show, diagrammatically, the movement of the TD pile for each quarter stroke of the power plunger, as well as the resulting pressure. Fig. 2 (Left)—Beginning of power stroke, TD pile at half stroke, moving toward the cold end. Fig. 3 (Below)—Power plunger at half stroke, TD pile at cold end



the lowest. This ideal is not fully realized in the Malone engine. Nevertheless, in the smaller sizes at least, it is credited with efficiencies considerably better than ordinary steam engines.

Figs. 2, 3, 4 and 5 show, diagrammatically and progressively, the operation of the engine. It will be noted, as already pointed out, that the eccentric crank is at all times 90 deg. ahead of the engine crank. Fig. 2 starts with the ram at the right of the cylinder, the TD pile at its mid-stroke and with a pressure of 5.3 tons per square inch.

When the engine shaft advances one-quarter of a revolution (Fig. 3) the ram moves half a stroke out of the cylinder. Simultaneously, the TD pile moves to the cold end of the TD tube, transferring and heating the water. The pressure falls to 4.3 tons per square inch.

Next (Fig. 4) the engine is moved through its second quarter revolution. The ram moves out to the end of its stroke. Simultaneously, the TD pile moves from the cold end of the TD tube half way back, cooling part of the water. The pressure falls to 1.4 tons per square inch.

When the engine moves through the third quarter of a revolution, the ram moves half a stroke into the cylinder, and the TD pile moves from its half-stroke position to the hot end of the TD tube, thus cooling all the transferred water. The net resulting pressure is 2.3 tons per square inch.

When the engine stroke completes the fourth quarter of a revolution the ram moves to the inward end of its stroke. Simultaneously, the TD pile moves from the hot end of the TD tube to its mid-position, as in Fig. 2. The pressure rises to 5.3 tons per square inch.

It will be noticed that while the TD pile is moved from the hot end to the cold end of the TD tube, liquid moves in only one set of passages of the TD pile in passing from the cold end to the hot end. During this movement the liquid in the TD pile takes heat from the metal and the stationary water (from the reverse flow) in the TD pile. The heat is received at an average pressure of 4.3 tons per square inch. When the TD pile is moved in the opposite direction the heat is given up at an average pressure of 2.35 tons per square inch.

The power of the engine is controlled by altering the stroke of the TD pile. It is reversed by two eccentrics and a link motion.

In his paper before the Royal Society, Mr. Malone said that many liquids, aside from water, had been tested, but that, with the possible exception of mercury, water seemed to be the most suitable.

The TD pile in the actual engine is not as simple as that shown diagrammatically, but is built up of a number of concentric tubes with water films between the tubes. The thickness of the liquid film in one of these TD piles is one-hundredth of an inch.

The heating unit is shown diagrammatically at the right of Fig. 1. As described by the author, "the heating unit has a mechanically operated gas circuit which takes a weight of hot gas at maximum temperature into itself from the furnace, and rejects from itself the same weight of gas at the coldest part of the gas circuit. The gas circuit, at its coldest part, injects some of the gases into the preheater, the remainder moving around the gas circuit at its lowest temperature, and takes into itself some of the furnace gases at their hottest temperature.

"The resultant mixture, at a medium temperature, circulates around the hot end of the TD tube, and in heating the tubes, and therefore the liquid inside them, cools the heating gases. These cooled gases move around the circuit

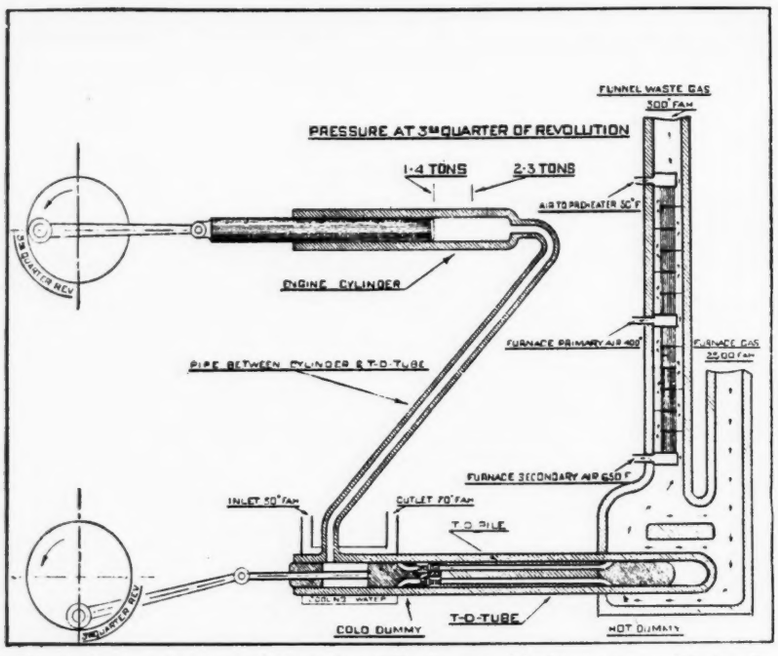


Fig. 4—Power plunger at full stroke. TD pile moved half way toward hot end

either to the preheater or mix again with the hot furnace gases." In this way excessive heating is avoided.

Several experimental engines were built. Extensive experiments were carried out with this engine between 1925 and 1927. This engine was vertical, and had 80 TD piles operated by a cam.

In 1927 a small horizontal engine was built, which has run well over 30,000,000 revolutions. The speed of this engine may be varied between 40 and 250 r.p.m., and the TD pile stroke varied between $\frac{1}{4}$-in. running light, and $3\frac{1}{2}$-in. running on full load. "With everything cold, and from ten minutes of lighting up the furnace," said Mr. Malone, "this engine was running smoothly."

A second vertical engine was also built, with 20 small tubes and two engine cylinders.

Tests of the horizontal engine by three different independent engineers gave 27 per cent indicated efficiency, from which the author concluded that after allowing for furnace and mechanical losses in a good commercial engine of 100 b.hp. and upward, 20 per cent over-all efficiency between fuel and shaft could be expected.

Mr. Malone particularly recommended this engine for locomotive use, where its decreased coal consumption, zero water consumption and greater starting effort would give it many advantages. He expressed the wish that the engine would be developed by existing manufacturers of steam engines.

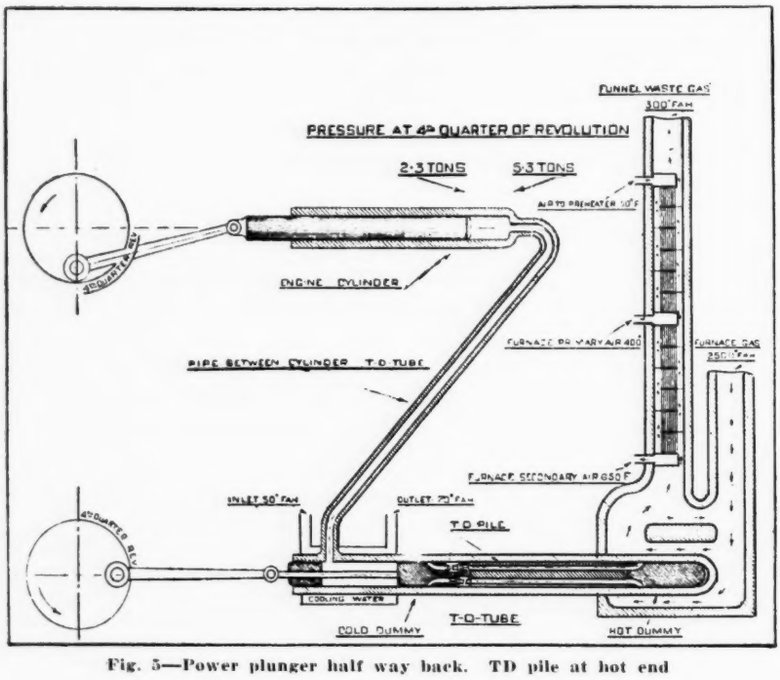


Fig. 5—Power plunger half way back. TD pile at hot end

The Effect of Oil in Exhaust Steam

UNDER THE HEADING "The effect of lubrication on the use of exhaust steam for process heating," the July-August issue of *Lubrication* gives some practical information on this subject, which may be summarized as follows:

It is important to remember that wherever exhaust steam is to be used either directly or indirectly for heating it will virtually always contain a certain amount of cylinder oil.

Where steam is passed directly to dye vat, tanks or open-type steam water heaters, it may carry a certain amount of oil into the liquid to be heated; the oil, in turn, may be passed on to the goods under treatment or back to the boiler. In either case it may be a decided handicap.

Very frequently steam cylinders of engines, pumps or compressors are overlubricated, accentuating the troubles arising from oil carried over.

Oil is particularly objectionable in dyeing operations, where steam is generally used direct. However, oil separators are available that can be depended upon to remove any cylinder oil which might be detrimental to products such as silk or rayon. If no separators are used it may be necessary to underlubricate the engines.

Oil has a decidedly detrimental effect on boiler operation, increasing foaming and priming and so reducing the rate of heat transfer at certain points that burn-outs are likely to occur.

The use of oil separators on lines supplying exhaust steam to paper calendars will prevent accumulations of oil and grease on the inside of the rolls. These would materially reduce the rate of operation of the machine.

The purpose of compounding lubricating oils is to improve the adhesiveness of steam cylinder lubricants. The presence of moisture in steam will usually result in a film of straight mineral lubricant being rapidly washed off from the cylinder walls. To secure proper lubrication it is necessary to increase the rate of flow and substitute an oil which contains a certain percentage of fatty compounds, such as lard oil, degras or tallow.

Where a compounded oil is used an emulsion is developed by the moisture in the steam reacting with the fatty compound. The lubricating film must have a greater affinity for the cylinder walls and other wearing surfaces and become highly resistant to the washing action of the water in steam. In general, the compound should not exceed 10 per cent, except in cases of abnormally wet steam.

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NEW ORDERS for 816 steel boilers were placed in July, according to reports submitted to the Bureau of the Census by 74 manufacturers comprising most of the leading establishments in the industry, compared with 818 boilers in June and 1,309 boilers in July, 1930.

THE ENGINEER'S BOOKSHELF

Electric Utility Data

THE ELECTRIC LIGHT AND POWER INDUSTRY IN THE UNITED STATES. *Compiled and published by the National Electric Light Association, 420 Lexington Ave., New York City; 1931. Paper, 8x11 in.; 188 pages; illustrations, charts and tables. Price, $1.75.*

RECENTLY made available to the general public, this revised edition of the N.E.L.A. Handbook contains a detailed account of every phase of the electrical industry from the days when Thales first noted the attraction which amber, when rubbed, has for light objects to the very latest developments in generation and distribution.

Divided into 25 chapters its pages are packed full of information concerning the utilization of electricity in industry, the office, the home and on the farm; financing and investment; holding and management companies; steam and water-power development; government ownership; public utility regulation, taxes, rates, service, future development, etc.; cost of manufacture and ultimate delivery of electricity; radio broadcasting; visual education; and many other subjects, including transportation and the gas industry. One entire chapter is given over to statistics of the industry and an 8-page bibliography covers completely the more important literature on the subjects of electricity and the electrical industry.

Altogether it is probably the most interesting and informative book on electric light and power.

Engineering Economics

ECONOMICS FOR ENGINEERS. *By Edison L. Bowers and R. Henry Rowntree, both of the department of economics at Ohio State University. Published by the McGraw-Hill Book Company, 370 Seventh Ave., New York City; 1931. Cloth, 6x9 in.; 490 pages; charts and tables. Price, $4.*

IT IS IMPOSSIBLE to peruse this book without becoming aware almost instantly of the fresh, lively way in which the authors treat the venerable subject of economics. Far from the dry, theoretical studies most of us associate with "political economy," this book portrays the vastly interesting potentialities of a vital social science. And not without sly humor here and there at the expense of human frailties, it admirably bridges the gap between erudite theory and practical economics.

Written particularly for engineers and engineering students, the book presents a general analysis of the modern economic system. The opening chapters deal in an interesting manner with the relation of economics to engineering, standards of measurement, the evolution of modern industry and the influence of human traits on consumption of economic goods. Full and practical treatment is then given the subjects of supply and demand, prices, wages and capital return. The most pertinent phases of management, domestic and international marketing, investments, insurance and cyclical fluctuations are covered, together with the social and governmental aspects of the business system. Of particular interest at the present time is the concluding chapter on "The Efficiency of the Economic Machine," in which many of the problems arising from our rapid technical progress are considered.

No brief summary of the scope of this book, however, can possibly convey the enlivening treatment the authors have given their subject. It must be read, and should be by all who find it necessary to familiarize themselves with the operation of the economic system. This, of course, includes engineers, who are more and more being called upon to handle business problems. They, particularly, will find in this book information adapted to their practical needs, as well as a stimulating portrayal of the social aspects of their work.

Interstate Power

INTERSTATE TRANSMISSION OF ELECTRIC POWER: A STUDY IN THE CONFLICT OF STATE AND FEDERAL JURISDICTIONS. *By Hugh Langdon Elsbee, instructor in government, Harvard University. Published by the Harvard University Press, Cambridge, Mass.; 1931. Cloth, 5x8 in.; 212 pages. Price, $2.50.*

BASED on a review of court and public utility commission rulings on questions of interstate transmission of electric power, the author outlines the legal and administrative problems involved and recommends certain proposals for regulation.

Tracing the history of United States Supreme Court decisions, a lack of established policy is found in handling this problem, particularly on the basic point regarding the natural-resource classification of hydro-electric power. Special attention is paid to the question of interstate contracts for wholesale power. Regulation of security issues by state commissions is shown to be weak under present conditions because of lack of jurisdiction over companies doing business in several states.

State commissions, the author says, are "growing more and more hostile to federal intervention." The book brings to date the legal and administrative phases of this rapidly growing problem.

Reviewed by M. N. BAKER.

Electrical Insulation

THE NATURE OF A GAS. *By Leonard B. Loeb, professor of physics at the University of California. Published by John Wiley & Sons, Inc., 440 Fourth Ave., New York City; 1931. Cloth, 6x9; 153 pages; tables and diagrams. Price, $2.50.*

THIS BOOK, issued as Monograph No. 1 by the National Research Council's Committee on Electrical Insulation, is a good example of the close relation of pure science to applied. The book makes no mention of electrical insulation nor has it apparently direct bearing on any practical problem. The treatment throughout is that of pure science, of a search of facts purely for their own sake.

Publication of such a book, as the monograph of a practical committee, means only that insulation problems will not be solved until the fundamental scientific laws behind them are understood.

The book summarizes the classical kinetic theory of gases, and relates it to what is now known regarding the structure of the atom, the paths of electrons, etc. Molecular structure is treated at length. Considerable attention is given ionization phenomena.

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Brief Reviews

BOILER HOUSE MANUAL. By B. Frisby. Published by Crosby Lockwood & Son, Stationers' Hall Court, Ludgate Hill E.C.4, London, England; 61 pages, illustrated.—Gives in simple language a few general suggestions about the operation of boilers, together with formulas covering the air required for combustion, draft, efficiency, etc., and various useful tables.

LCODE. Compiled and published by The Business Code Company, 2 Rector St., New York City; 224 pages; price $6.—Standard telegraph code for the purchase and sale of electrical equipment and supplies, sponsored by the N.E.M.A., N.E.L.A., and five other electrical societies.

CONSTRUCTION COSTS 1930. Compiled and published by the *Engineering News-Record*, 475 Tenth Ave., New York City; 110 pages, illustrated; price $1.—A compilation of the volume of construction, cost index numbers, railroad indexes, public utility values, prices of materials, labor rates and unit prices in the construction field.

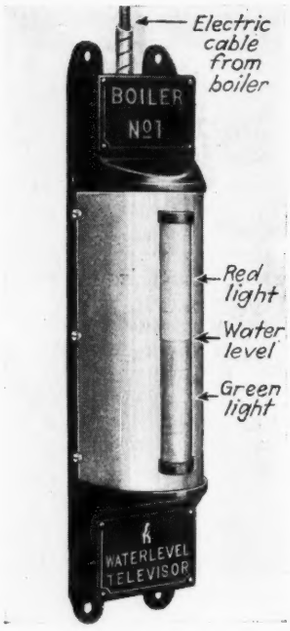
LA CONSTRUCTION DES TURBINES À VAPEUR EN SUISSE. By Charles Colombi. Published by the Office Suisse D'Expansion Commerciale, Bellefontaine, Lausanne, Switzerland; 47 pages, illustrated; price 2 francs. A technical analysis of the design and construction of steam turbines as practiced in Switzerland.

WHAT'S NEW IN PLANT EQUIPMENT

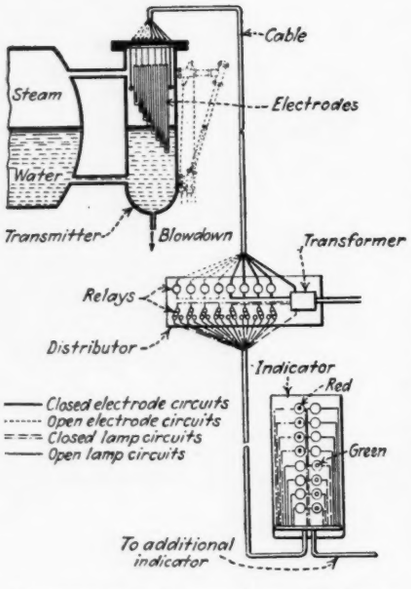
Water-Level Televisor

To PROVIDE a practical means of indicating at one or more distant points the water level in a steam boiler, tank or other vessel, the Schutte & Koerting Company, 1150 Thompson St., Philadelphia, Pa., has developed the water-level televisor illustrated.

It consists, essentially, of three units, transmitter, distributor and indicator. The transmitter, consisting of a cylindrical water chamber containing a set of electrodes that make contact with the boiler water, is connected to the boiler drum as shown. With a gage glass attached it may be used in place of the regular water column or may be installed in conjunction with it. The electrodes in the transmitter are of different lengths. The outer electrodes (tubes) are fastened to a supporting plate suspended from the cover; the inner electrodes are attached to terminals on the cover by small rods. Inner electrodes are separated from the outer by radial glass pins, electrical contact between the two being made by the water in the boiler. The electrode assembly is connected by multiple-wire cable to a distributor containing a transformer and a set of relays of the magnet-coil, double-pole, mercury-contact type. In the distributor, line current is stepped down to 24 volts for operation of the relays and to 12 volts for operation of the lamps on the indicator.



Indicator used with televisor

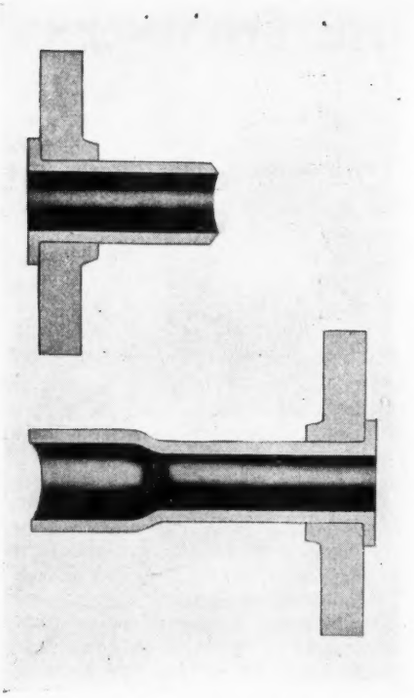


Arrangement of transmitter, distributor and indicator

The indicator contains two vertical rows of small lamps (standard automobile headlight bulbs), the right-hand set illuminating a green glass, the left-hand set a red glass. The colored light reflected from these lamps shows in a long prism on the front of the indicator.

When an electrode circuit is closed by a vise in the water level in the boiler the corresponding magnet coil in the distributor tilts its mercury contactor and lights a corresponding lamp in green section, the opposite red lamp remaining dark. When an electrode circuit is broken the reverse takes place. A separate transmitter and distributor is used for each boiler, but any number of indicators can be connected to one distributor.

Televisors suitable for use on closed feed-water tanks and open water-supply tanks are also available.



Butt-weld and cup-weld welding stubs

Loose-Flange Welding Stubs

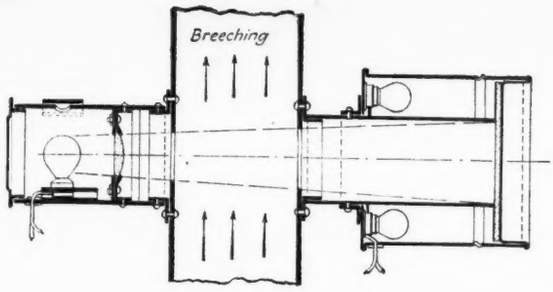
LOOSE FLANGE welding stubs of the cup-weld and butt-weld patterns are now being offered by the National Valve & Manufacturing Company, Pittsburgh, Pa.

Furnished in sizes as small as ½-in., they can be used in high-pressure drips, drains, bypasses, soot blower piping and other small lines where the service is severe. The stub is made of length sufficient to prevent distortion of the lap when properly welded in the line. The laps are completely machined front and back and flanges are bored to give minimum clearance. Sizes from ½ to 24 in. are available.

Smoke-Density Indicator

THE ILLUSTRATION shows a cross-section of a smoke indicator, designated Smokometer, attached to a smoke pass-

Front view of indicator



View showing how beam of light is projected across smoke passage

age—stack, breeching or uptake—and also a front view of the indicator. The instrument consists of a projector throwing a beam of light across the smoke passage to an indicator attached on the opposite side of the passage.

Smoke particles in the beam cast shadows on the inner circle of the indicator, the density of the shadows varying with the amount of smoke. Around this central part of the indicator are illuminated sectors graduated in the Ringelmann scale of smoke density. The shadows on the center portion may be compared directly with these standard density scales. This gives a continuous picture of the smoke conditions.

If the location of the uptake or smoke passage does not permit direct observation of the indicator from the firing aisle, images of the indicator may be reflected by mirrors to any desired point. A number of images from different boilers may be converged to a common mirror for central observation; or images from the same instrument may be reflected to different points.

It is not necessary to view the instrument or image from a point directly in front. The shadow scale and smoke chart being on the same plane and illuminated permit of a wide angle of vision. Also, since the instrument is provided with its own illumination, it is not necessary to provide shields or hoods to prevent other lights in the boiler room from interfering with observation.

The Smokometer is manufactured by The Sales Corporation, Richmond, Va.

Coal Pulverizer of One to Six Tons' Capacity

To MEET the demand for a small pulverizing unit suitable for use in small- and medium-sized industrial boiler plants, the Fuller Lehigh Company, 85 Liberty St., New York City, has developed the Type C pulverizer illustrated.

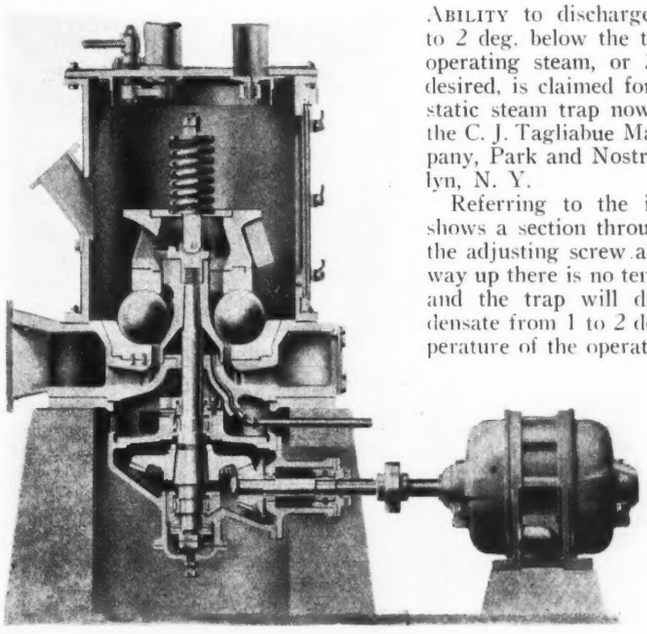
The design of this mill embodies the ball and grinding ring principle of pulverizing similar to that used in the Type B pulverizer described in the Nov. 4, 1930, number. The pressure between the grinding parts is applied and maintained by a heavy steel spring mounted in the top section of the mill.

Raw coal, crushed to pass through a ¾-in. ring, is fed to the mill from an overhead bunker by a table-type feeder. The coal, upon entering the mill, drops into the path of the grinding balls, where it is pulverized. Tramp iron or other foreign material that may enter the mill with the coal is at once rejected outward from the grinding zone by the grinding balls and can be removed through the access door in the top section.

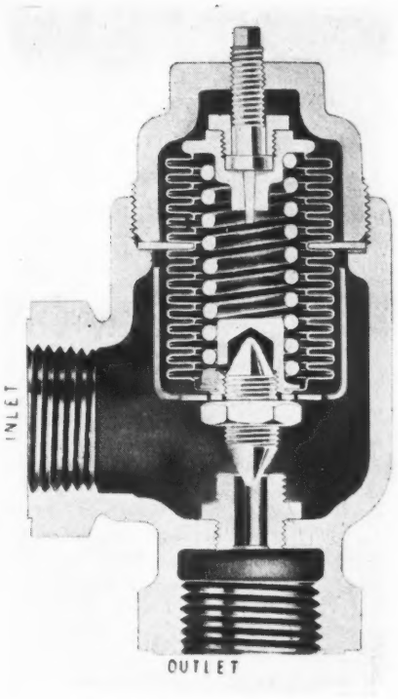
The air for separating the fine particles of coal from the coarse enters the mill under pressure through the air inlet in the intermediate section. The air currents pass through this section into the annular passage between the stationary grinding ring and the driving yoke and, in flowing upward, pick up the finer particles of coal and remove them from the grinding zone.

Continuing their upward movement, the pulverized-coal and air streams are discharged through ports in the rotating spider. An overhanging flange, cast around the top of the spinder, prevents the streams from rising to the top of the mill until they are projected outward and subjected to the classifying action of the spider as it rotates. Here the coarse particles of coal are separated from the fines and drop back into the grinding zone for further pulverizing, while the streams of finely pulverized coal and air continue to the top of the mill and are discharged directly to one or more burners through pipes connected to the top of the mill housing.

Type C pulverizers are available in several sizes and in capacities ranging from 1 to 6 tons of coal per hour.



Cross - section through Fuller Lehigh Type C pulverizer



Tagliabue thermostatic trap

Thermostatic Steam Trap

ABILITY to discharge condensate at 1 to 2 deg. below the temperature of the operating steam, or 24 deg. below, as desired, is claimed for the new thermostatic steam trap now being offered by the C. J. Tagliabue Manufacturing Company, Park and Nostrand Aves., Brooklyn, N. Y.

Referring to the illustration, which shows a section through the trap, when the adjusting screw at the top is all the way up there is no tension on the spring and the trap will discharge the condensate from 1 to 2 deg. below the temperature of the operating steam. When tension is applied to the spring by means of the screw a mechanical pressure is created on the inside of the bellows which aids the vapor pressure developed in the bellows to close the valve. Thus the adjustment of the screw determines whether the trap will close at the temperature of the operating steam or at 15 to 25 deg. below this temperature and, in reverse effect, whether it will open to discharge condensate at 1 to 2 deg. below the operating steam temperature or a corresponding number of degrees below that temperature.

The trap is fitted with reversible as well as renewable seats and disks. It is made in 1-in. size only.

NEWS of the FIELD

New National Safety Code for Elevators Approved by American Standards Association

A NEW national safety code for elevators, dumbwaiters and escalators, developed under technical direction of the American Society of Mechanical Engineers, the American Institute of Architects, and the United States Bureau of Standards, has just been approved by the American Standards Association. Approval of the revised code by the association followed nearly four years of research on elevator safety devices at the Bureau of Standards and extensive investigation by a technical committee composed of 38 representatives of architectural, engineering, governmental, and other organizations. Sullivan W. Jones, former state architect of New York and representative of the American Institute of Architects, is chairman of the committee, and John A. Dickinson, research fellow of the Bureau of Standards, who conducted the research work at the Bureau, is secretary.

In the tests conducted during the research work, the suspended elevators were fully loaded and released from their cables, allowing them to fall freely in the shafts. Motion picture apparatus, fixed under the elevators and clicking off pictures at the rate of 3,600 per minute, revealed the precise operation and trustworthiness of the safety devices. Loaded elevators were also dropped onto the buffers at the bottom of the shaft and especially designed apparatus measured the forces involved during the fraction of a second before the plunge was completely stopped. This research led to the redesign of almost all elevator buffers.

For the first time the national elevator code permits the operation of more than one elevator in a single shaft, thus removing one of the obstacles to the erection of skyscrapers—the excessive space required for elevators. The code provides rigid safeguards to eliminate any possibility of collision between two elevators in the same shaft. The code also provides for two-story cars which consist of two separate cages, one above the other to serve two floors simultaneously from the same shaft. These will not be "one man cars," however, an operator for each of the two cages being required by the code. Safety devices will prevent the two-story car from moving until the safety gates of both cages are closed.

Further provision is made for a new type of express-local system in which the master express elevators will stop at only three or four express or plaza floors, ten, fifteen, or even more stops apart, at which points passengers will transfer to local elevators starting from the plaza floors rather than all from the first floor, the present practice in skyscrapers.

The code insists upon fireproof elevator shaft enclosures and fireproof housing for the elevator machinery so that elevator evacuation of a fire-swept skyscraper will be possible.

Although the framers of the code found that present safety devices would permit safe elevator operation at any speed, it is believed that the limit of speed will not go much beyond 1,200 ft. per minute because of the discomfort to passengers resulting from rapid change in air pressures in ascent or descent.

Any speed above 700 ft. per minute requires automatic operation with automatic floor leveling devices because of the difficulty of stopping more rapidly moving cars at floor levels. It was also found that at speeds of over 800 ft. per minute an operator could not read floor numbers 4 ft. high.

The code also includes provisions for the safe operation of freight and other types of elevators, the passenger-operated lifts, escalators and dumbwaiters. Copies of the code may be ordered from the A.S.A. at $1 each.

Idaho Power Tax Is Declared Constitutional

BY A DECISION of three federal judges in statutory court at Boise, Idaho, on Aug. 20, the kilowatt-hour tax recently enacted by the Idaho legislature, was held constitutional insofar as the state questions raised were concerned. The court also held that the question as to whether or not the entire operation of generation, transmission and distribution of electric power is in interstate commerce, was one upon which it desired further information. That part of the question is therefore left open for further evidence.

The decision was rendered on a suit brought by the Utah Power & Light Company for an injunction to prevent collection of the tax, which amounts to one-half mill per kilowatt-hour on all electric power generated in the state. The suit attacked the constitutionality of the act creating the tax, and declared that it interfered with interstate commerce by taxing a commodity which goes instantly into interstate commerce when generated. Moreover, it was assailed as a double tax in that the company is already paying a license tax, a property tax, and an income tax.

Levying of the tax would cost the power company approximately $120,000 a year, the suit stated, while very little of the power generated is used in Idaho, most of it going to Utah.

Largest Diesel-Driven River Towboat Completed

DELIVERY has been made to the Inland Waterways Corporation of a new diesel-driven towboat which is regarded as the most powerful vessel of its kind ever built. The new towboat, which has been named the "Herbert Hoover," was built by the Dubuque Boat & Boiler Works, of Iowa, and was designed for service on the lower Mississippi division of the government barge line. It will be able to move 10,000 tons of freight up the river from New Orleans to St. Louis at an average speed of better than four miles an hour.

While diesel propulsion has long been regarded as advantageous for inland waterway service, the difficulty has been to find some method of applying it to shallow draft craft. The old stern paddle wheel, which became a familiar sight on the Mississippi in the days of the pacquet steamers, has been found to be ideal for navigation in shallow water. It has been found difficult from a mechanical standpoint to gear a diesel engine down to the speed of a slow revolving paddle wheel. The question has been solved by the use of a tunnel type propeller that can be used in extremely shallow water.

The twin screws of the "Herbert Hoover" are driven by two 1,100-hp. McIntosh & Seymour diesels. These engines are of trunk-piston eight-cylinder design. The height of the engines has been reduced to conform to the limitations imposed by the design of the towboat and the weight is within convenient bounds. River water is filtered before being used for cooling the engines.

First High-Pressure Gas Line for New Hampshire

PERMISSION has been granted to the Public Service Company of New Hampshire by the Public Service Commission of the state to construct a fifteen-mile high pressure gas pipe line from Laconia to Franklin. The company has also received the authority to serve the intervening communities of Belmont, Sanbornton, Tilton and Northfield.

When this new line is completed it will be the first long distance high pressure gas line in the state.

The modernized plant at Laconia will be able to use its present excess capacity as a result of this interconnection and this will permit lower unit costs for gas output, it is stated by the company. The plant now in use at Franklin is inadequate to meet the increasing demands.

Work to Be Started Soon On Yakima (Wash.) Project

ERECTION of the $3,656,000 hydro-electric power plant near Yakima, Wash., in connection with the construction of the Cle Elum dam will be started soon, according to Charles Bartholet, who issued the last of the water power permits to the Federal Reclamation Service. Plans call for the construction of a fourteen-mile canal from Selah Gap to Union Gap, where the power house will be erected. Under the permits issued by the state, the power plant will be returned to the irrigation district, subject to congressional approval, when the profits from operation have repaid the construction costs.

Approximately $150,000 revenue a year will be afforded from the plant when it is completed, it was stated by E. J. Barnes, state director of conservation and development. During summer months at least 30,000 hp. will be furnished by the plant to be wholesale to private power companies for about 4 or 5 mills a kilowatt-hour, he said. In winter months, however, there would be hardly more than 4,000 or 5,000 hp. for sale.

Benning Power Station Operators Get 6-Day Week

AN ORDER has been issued by officials of the Potomac Electric Power Company at Washington, D. C., placing the Benning power plant on a six-day basis as far as the employment of steam engineers and electricians is affected. There are 127 steam engineers and electricians at the power plant. It is estimated that approximately two score new jobs will be open to central power plant workers as the result of putting the present employees on a six-day week.

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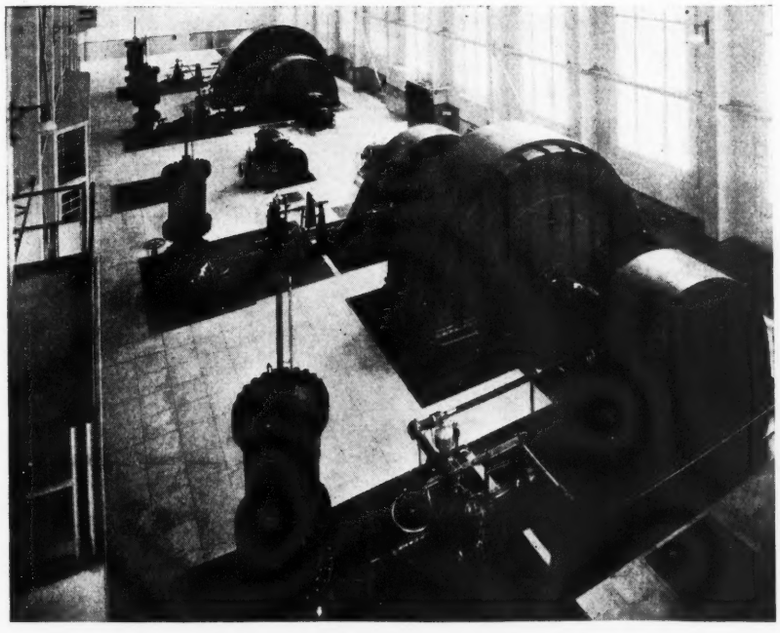
TIGER CREEK POWER HOUSE COMPLETED



Interior view of the Tiger Creek power house recently completed by the Pacific Gas & Electric Company on the Mokelumne River in California. This power house has a generating capacity of 60,000 kva. developed by two 30,000-kva. units of the double overhung impulse wheel type, served by two of the 36-in. diameter penstocks. The turbines operate under a net effective head of 1,190 ft. Each waterwheel unit consists of two overhung impulse Pelton wheels rated at 18,000 horsepower

News of Canada

Herridge expected to discuss St. Lawrence treaty; Montreal power lines dynamited; eighth Paugan unit nears completion

IT IS INTIMATED in political circles at Ottawa that there is a reasonable prospect that just as soon as the government has completed its plans for dealing with the unemployment situation during the coming winter, it will renew negotiations with the United States on the subject of St. Lawrence waterway and power development. W. D. Herridge, the new Canadian Minister to Washington, will take up his permanent abode there shortly, when the opportunity will be presented —and very probably availed of—to discuss the whole subject. As has been stated repeatedly by members of the government and power authorities in Canada there are many considerations to be taken into account and also some obstacles in the way, but they are not considered insurmountable.

In the meantime, the question of whether power ownership in the Canadian section is vested in the Dominion or the provinces will have to be settled. The Supreme Court held the previous reference to be too abstract and asked for a concrete case, which is now afforded by the Beauharnois situation. The province of Quebec claims the power rights in the Beauharnois canal. It leased 500,000 sec.-ft. of the flow to the company. The former administration, while not conceding provincial title, agreed to waive its rights, stating that it did not propose to enter the field of power development. As to the legality of this stand, doubt has been raised, however, and the Bennett administration will submit the concrete question to the courts.

CLIMAXING a week of sabotage during which the city of Montreal was repeatedly threatened with a complete power shortage, a huge steel transmission tower on the side of the Lachine Canal was dynamited from its base on Aug. 19. The tower was dangerously canted over the canal, supported by its power wires. On the same day the electrical service of the city was affected when two towers of the Shawinigan Water & Power Company on the outskirts of the city were dynamited and toppled over, the four high-powered circuits on the poles being severed. Destruction of aids to electrical connections in Montreal has been rife following a strike of 175 linemen employed by the Montreal Light, Heat & Power Consolidated. These men are members of the Canadian Union of Linesmen and Helpers, which the company has refused to recognize. Officials of the Union disclaim any responsibility for the damage done. The dynamiting of power lines continued on Aug. 20,

when a pole carrying three 12,000-volt transformers was blown up in the north end of Montreal, leaving half of the suburban town of St. Laurent without electric service.

INSTALLATION of the seventh 34,000-hp. generator in the Paugan Falls plant of the Gatineau Power Company, on the Gatineau River, Quebec, is progressing rapidly. The speed-ring, head cover, and scroll case have been completed, and the waterwheel shaft has been received at the plant. As the station is designed for eight generators, no extension of the power-house structure has been required for the new unit. Only the cost of the machinery is involved, resulting in a comparatively low additional capital cost per horsepower. Upon the starting of the new unit, the Paugan plant will have an installed capacity of 238,000 horsepower.

Simplified Practice Body Studies Heating Boilers

A SUMMARY REPORT of a variety survey of low-pressure steel heating boilers, recently conducted cooperatively by the industry and the Division of Simplified Practice, shows that 21 firms representing over 90 per cent of the 1930 output made total shipments of 7,805 boilers, of which over 76 per cent were of the welded combination type. Of the total shipments, 3,036 boilers were to be mechanically fired.

Eighteen different kinds of boilers were reported, each made in from 6 to 132 different capacity ratings. The total variety aggregated 1,072. An analysis of the two most popular kinds of boilers showed that over 84 per cent of the sales were made in 20 per cent of the capacities produced, and that no shipments were made in over 28 per cent of the capacities manufactured.

A detailed report of the survey is now in the hands of the simplified practice committee of the industry and is being used as a basis for the development of a simplified practice recommendation on the capacities of low-pressure steel heating boilers, as a step in eliminating avoidable waste.

Industrial Engineers to Meet in Pittsburgh, Oct. 14-16

THE EIGHTEENTH national convention of the Society of Industrial Engineers will be held on Oct. 14 to 16 at Fort Pitt Hotel, Pittsburgh, Pa.

At the opening session an address of special interest will be given on "The Status of Industrial Management in Russia Today," by John M. Carmody, editor of *Factory and Industrial Management* and national president of the society, who recently spent three months in Russia inspecting manufacturing plants, steel mills and power plants.

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COMING CONVENTIONS

American Society of Mechanical Engineers. Regional meeting in Kansas City, Mo., Sept. 7-9. Annual meeting in New York City, Nov. 30-Dec. 4. Secretary, Calvin W. Rice, 33 West 39th St., New York City.

American Association of Engineers. Seventeenth annual convention at Huntington, W. Va., Sept., 28-30. Secretary, M. E. McIver, Willoughby Tower, Chicago, Ill.

American Institute of Electrical Engineers. District meeting at Kansas City, Mo., Oct. 22-24. Annual winter convention in New York City, Jan. 25-29, 1932. Secretary, F. L. Hutchinson, 33 West 39th St., New York.

American Welding Society. Fall meeting at the Copley-Plaza Hotel, Boston, Mass., Sept. 21-25. Secretary, M. M. Kelly, 33 West 39th St., New York City.

Association of Edison Illuminating Companies. Forty-seventh annual meeting at The Greenbrier, White Sulphur Springs, W. Va., Sept. 21-25. Secretary, Preston S. Millar, 80th St. and East End Ave., New York City.

International Railway Fuel Association. Annual convention at the Hotel Sherman, Chicago, Ill., Sept. 15-16. Secretary, C. T. Winkless, Room 700, La Salle Street Station, Chicago, Ill.

National Association of Power Engineers. Annual convention and mechanical exposition in the Convention Hall, Kansas City, Mo., Sept. 7-11. Secretary, Fred W. Raven, 417 South Dearborn St., Chicago.

New England Water Works Association. Fiftieth annual convention at the Hotel Statler, Boston, Mass., Sept. 29-Oct. 2. Secretary, Frank J. Gifford, 715 Tremont Temple, Boston, Mass.

Southwest Power Conference and Show will be held in Convention Hall, Kansas City, Mo., Sept. 7-11. Secretary, George F. Klein, Chamber of Commerce, Kansas City, Mo.

Third International Conference on Bituminous Coal. At Carnegie Institute of Technology, Pittsburgh, Pa., Nov. 16-21. Chairman, Thomas S. Baker, president of Carnegie Institute of Technology.

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Lewis J. Brown, president of the Kellogg Company, Battle Creek, Mich., in an address entitled "What Has Happened?" will furnish some interesting data on their experiment of operating on four 6-hour shifts.

The second day of convention will be known as "Gilbreth Day," the program being arranged to commemorate the pioneer work of the late Frank B. Gilbreth, and its development by Dr. Lillian M. Gilbreth. In the evening the annual banquet will be held, the principal speaker being Joseph W. Roe of New York University, executive secretary of the American Engineering Council, as toastmaster.

Group meetings are scheduled for sales managers, production engineers, maintenance engineers, personnel directors and time study engineers.

Personals

H. H. SCHOOLFIELD has been appointed chief engineer of the recently consolidated engineering departments of the Pacific Power & Light Company and the Northwestern Electric Company, operating subsidiaries of the American Power & Light Company. Mr. Schoolfield, who has been in the Pacific company's engineering department since 1911, was made assistant chief engineer in 1915 and chief engineer in 1917. E. F. PEARSON, who became chief engineer of the Northwestern company a year ago, will function in much the same capacity as formerly with the title of assistant chief engineer of the combined departments.

WARREN VIESSMAN, who was appointed engineer in charge of the Bureau of Mechanical-Electrical Service of Baltimore, Md., in 1927, has resigned from that position to engage in private practice. Before becoming associated with the city, Mr. Viessman was with the Consolidated Gas, Electric Light & Power Company. LEON SMALL, who was chief of the bureau's engineering division and formerly with the Bureau of Water Supply, has been named to succeed Mr. Viessman by Mayor Howard W. Jackson.

CHARLES E. DOVE, who has been prominently identified with the Utilities Power & Light Corporation, of Chicago, since 1913, in various managerial capacities, has recently been made vice-president and general manager of the Central States Power & Light Corporation, with headquarters at Dubuque, Iowa.

LEROY F. RYLANDER, engineer in the employ of the Public Service Company of Oklahoma, will soon be presented with the Insull Medal for saving on April 27 the life of Lee George Williams, lineman's helper at Coweta. The medal is awarded by Samuel Insull to employees of member companies of the National Electric Light Association for successful cases of resuscitation after electric shock.

ALFRED LEROY ATHERTON has been named to head a new metal-tank mercury-arc rectifier division within the circuit breaker engineering department of the Westinghouse Electric & Manufacturing Company. Mr. Atherton has been identified with the miscellaneous engineering department and has been engineer in charge of rectifier development for the company.

DR. EDWIN F. NORTHRUP, engineer and inventor, has been awarded the Edward Goodrich Acheson Medal for 1931 by a unanimous vote of board of directors of the Electro-Chemical Society. Dr. Northrup was at one time (1903-10) secretary of the Leeds & Northrup Company. Since 1916, however, he has devoted his time mainly to the development of new methods of inductive heating.

Business Notes

READING IRON COMPANY, Reading, Pa., announces the consolidation of its general executive and general sales offices in Philadelphia, Pa., on the tenth floor of the Terminal Commerce Building at 401 North Broad Street.

LUKENWELD, INC. (Division of the Lukens Steel Company), Coatesville, Pa., announces the appointment of John S. Bleecker as manager of sales. Since 1928 Mr. Bleecker has been engaged in private engineering practice in the industrial and public utility fields. Previous to that he was associated with Stone & Webster, Day & Zimmermann and Bates, Inc., in the executive management of many of their enterprises.

WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY, East Pittsburgh, Pa., announces the appointment of R. R. Davis as apparatus advertising manager. Mr. Davis, who has directed various Westinghouse advertising activities for the past 21 years, will have charge of all of the apparatus advertising activities of the company except the merchandising department.

ALL MANUFACTURERS OF WELDED CHAIN who have accepted the simplified practice recommendation applying to their products have recently expressed their intention of identifying the simplified lines in their new catalogs and trade lists, according to an announcement of the division of simplified practice of the United States Bureau of Standards. This plan is designed to assist buyers in maintaining close adherence to the waste elimination program, it is stated, and the welded chain industry is the first to record 100 per cent identification.

ILLINOIS STOKER COMPANY, Alton, Ill., announces the appointment as sales representatives of Sullivan Valve & Engineering Company, 910 South Arizona St., Butte, Mont., and Leonard H. Pratt, 19409 Fleming Ave., Detroit, Mich.

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Trade Catalogs

PUMPS — Worthington Pump & Manufacturing Corporation, Harrison, N. J., has recently issued the following new bulletins: W-205-B1 on steam ejectors for stationary and marine service; W-310-S12A on Types CA and CB centrifugal pumps; W-319-S3 on Type WF centrifugal pumps with multi-stage turbine drive; L-711-S3 on two-stage dry vacuum pumps, belt or steam driven; W-112-S15 on horizontal duplex pot-type piston-pattern pumps for oil.

SPEED REDUCERS—Information on selecting the correct worm-gear speed reducer for each application is contained in the new catalog issued by the W. A. Jones Foundry & Machine Company, 4401 West Roosevelt Rd., Chicago, Ill. The catalog is fully illustrated and describes a full line of worm-gear speed reducers.

CONDENSERS—Elliott Company, Pittsburgh and Jeannette, Pa., has issued a new 24-page bulletin (C-7) on surface condensers. It contains data on the economics of surface condensers, heat transfer, tube layout and design and gives basic condenser formulas, charts, etc., together with many illustrations.

FLOW METERS—The theory of flow measurement and the operation, design and construction of the instruments used to measure liquid flow are described and illustrated in a 40-page illustrated bulletin (No. 173) recently issued by The Foxboro Company, Foxboro,, Mass.

SEALING COMPOUND—A brief review of the properties and applications of "Hydro Seal," a waterproof joint sealing compound for water, gas and air lines, is given in a recent folder of the Quigley Company, 56 West 45th St., New York City.

PACKING—The Goetze improved valve disc is described and illustrated in a folder recently issued by the Goetze Gasket & Packing Company, 500 Allen Ave., New Brunswick, N. J.

HEAT EXCHANGER—Information on the design and construction of the "G-R Equaflo" heat exchanger is given in an illustrated folder (Form 482) of the Griscom-Russell Company, 285 Madison Ave., New York City.

GASOLINE ENGINE-GENERATORS—The Sterling Engine Company, 1252 Niagara St., Buffalo, N. Y., has just issued an illustrated catalog of gasoline engine driven generators, ranging is capacities from 35 to 285 kw. The catalog contains many views of installations.

MOTORS—Bulletin No. 520, just issued by the Ideal Electric & Manufacturing Company, Mansfield, Ohio, contains descriptive matter, application data and dimension charts for the company's patented flywheel type synchronous motor and six other standard types of synchronous motors. Many installation views illustrate the bulletin.

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How's Business?

THE ENDURANCE DANCE of this unduly prolonged depression ought by all odds to end this month, if ever, according to *The Business Week*, Sept. 2. Precedent of 1921 favors this hopeful prospect, for in the summer of that year stocks and trade sloshed along in uncertain stagnation, as they have this time, till September. A strikingly similar advance improvement in textiles and other consumer industries, accompanied by sporadic strength in individual stocks standing out from the general list has appeared. Commodity price levels have shown unsually early and prolonged stability, and exports seem to have reached a resistance level. Still, the third week of August gives no sign of expected seasonal improvement, and scepticism about its prospective strength increases.

Production of electricity by public utilities for the week ended Aug. 22 was 1,643,229,000 kw.-hr., according to N.E.L.A. figures. This is 1 per cent above the previous week and 2.8 per cent below the corresponding period of 1930.

Fuel Prices

FUEL OIL

Boston—Aug. 24, tank-car lots, f.o.b. 12@14 deg. Baumé, 2.9c. per gal.; 28@32 deg., 4.85c. per gal.

New York—Aug. 27, f.o.b. Bayonne, N. J., 28@34 deg. Baumé, industrial use, tank-car lots, 3.75c. per gal.; f.o.b. Bayway, 36@40 deg., furnace, tank-car lots, 4.75c. per gal.

Philadelphia—Aug. 26, No. 3, industrial gas oil, $1.83 per bbl.; No. 4, light industrial fuel oil, $1.31 per bbl.; No. 5, medium industrial fuel oil, $1.20 per bbl.; No. 6, heavy (Bunker C), $1.05 per bbl.

Pittsburgh—Aug. 19, f.o.b. local refinery, fuel oil, 30@34 deg., 2.5c. per gal.; 36@40 deg., 2.75c. per gal.

Cincinnati — Aug. 25, tank-car lots, f.o.b. local refinery, 24@26 deg. Baumé, 4.5c. per gal.; 26@30 deg., 4.75c. per gal.; 30@32 deg., 5c. per gal.

Chicago—Aug. 24, tank-car lots, f.o.b. Oklahoma; freight to Chicago, 90c. per bbl. or 42 gal.; 18@22 deg., 22.5c. per bbl.; 22@24 deg., 25c. per bbl.; 24@26 deg., 27.5c. per bbl.; 26@28 deg., 32.5 per bbl.; 28@30 deg., 37.5 per bbl.

St. Louis — Aug. 25, tank-car lots, f.o.b. St. Louis, 24@26 deg., 99.5c. per bbl., or 42 gal.; 26@28 deg., $1.07 per bbl.; 28@30 deg., $1.17 per bbl.; 30@32 deg., $1.22 per bbl.; 32@36 deg., gas oil, 2.526c. per gal.; 38@40 deg., distillate, 3.026c. per gal.

Dallas—Aug. 22, f.o.b. local refinery 24@26 deg., 65c. per bbl. or 42 gallons.

COAL

Bituminous (Net Tons)	At Mine, for Shipment to	Price per Ton
Pool 9, super low-vol..	New York...	$1.60 @$1.80
Pool 10, h. gr. low-vol.	New York...	1.50 @ 1.60
Pool 11, low-vol.....	New York...	1.35 @ 1.45
Smokeless, mine-run..	Chicago.....	1.50 @ 1.75
Smokeless, slack.....	Chicago.....	.50 @ 1.10
Harlan, Ky., slack....	Chicago.....	.75 @ 1.00
Franklin, Ill., mine-run	Chicago.....	2.15
Franklin, Ill., screen...	Chicago.....	1.10 @ 1.60
Ind. 5th Vein, m.-r....	Chicago.....	1.20 @ 1.75
Standard Ill., mine-run	St. Louis....	1.25 @ 1.40
W. Ky., mine-run	Louisville....	.85 @ 1.00
W. Ky., slack.....	Louisville ...	.60 @ .75
Pittsburgh, mine-run.	Pittsburgh....	1.25 @ 1.45
Smokeless, mine-run..	Cincinnati...	1.60 @ 1.75
Smokeless, slack.....	Cincinnati...	.75 @ 1.10
Kanawha, mine-run..	Cincinnati...	.90 @ 1.25
Kanawha, nut-slack.	Cincinnati...	.65 @ .90

Anthracite (Net Tons)	At Mine, for Shipment to	Price per Ton
Buckwheat.....	New York...	$3.25
Barley.....	New York...	.90 @ 1.40

New Plant Construction

COMPILED BY THE MCGRAW-HILL BUSINESS NEWS DEPARTMENT, WHICH IS PREPARED TO FURNISH A MORE COMPLETE DAILY SERVICE TO THOSE WHO WISH IT

Ark., Little Rock—Arkansas State Military Department, c/o Lt. Col. Edward Woodford, State House, awarded contract for installation of 250 g.p.m. centrifugal pump and 1,000,000 gal. water reservoir at Camp Pike, six miles north of Little Rock to W. F. Moody & Co., A. O. U. W. Bldg., Little Rock.

Calif., San Diego—Bureau of Yards & Docks, Navy Dept., awarded contract for a steam plant for physical instruction, gymnasium and welfare building at Naval Air Station, to A. C. Reed & Co., San Diego.

Conn., Willimantic—Windham County Memorial Hospital, G. E. Taylor, Chn. Bldg. Comm., will receive bids until Sept. 9 for the construction of a hospital, nurses' home, power plant and laundry at West Main and Mansfield Sts. Estimated cost $500,000. Crow, Lewis & Wick, 200 5th Ave., New York, are architects. C. S. Neegard, 512 5th Ave., New York, N. Y., is engineer.

Kan., Topeka — Fleming-Wilson Mercantile Co., 116 Kansas Ave., lessee, and Santa Fe Land & Improvement Co., Santa Fe Bldg., awarded contract for the construction of a 160 x 160 ft. warehouse including large refrigeration plant and cold storage rooms, at Euclid Ave. and Santa Fe R.R. to Austin Co., 510 North Dearborn St., Chicago, Ill. Estmated Cost $100,000.

Kan., Winfield—State Board of Administration, State House, Topeka, awarded contract for the construction of a complete sewage treatment plant, including pump house, filters, tank, etc., to March Construction Co., Lawrence, Kan. $21,000.

La., Monroe—United Gas Public Service Corp., has work under way on the construction of a gas compressor station, 60,000,000 cu.ft. daily capacity near Alto.

Md., Catonsville—Spring Grove State Hospital, will soon award contract for the construction of a power house, coal pocket, railroad switch and alterations to insane building. Henry Powell Hopkins, 10 East Mulberry St., is engineer.

Mass., Barnstable—E. R. Grabon, c/o W. A. Swasey, 320 5th Ave., New York, N. Y., Archt., plans the construction of a 5 story hotel here. Estimated cost $1,000,000.

Mass., Boston—Christian Science Publishing Co., and The Christian Science Monitor, c/o C. L. Churchill, 9 Newbury St., Archt., awarded contract for the construction of a publishing building and service plant at Back Bay Section to Aberthaw Co., 80 Federal St. Estimated cost $3,000,000.

Mass., Franklin—New England Power Association, 89 Broad St., Boston, awarded contract for the construction of a sub-station and power lines here to New England Power Construction Co., 89 Broad St., Boston. Estimated cost $200,000.

Mass., Franklin—Union Light & Power Co., P. Poirier, Supt., 25 East Central St., awarded contract for the construction of an open air power station on Peck St. to New England Power Construction Co., 89 Broad St., Boston, Mass. Estimated cost $200,000.

Mass., Gardner—Dept. of Mental Diseases, Boston, will receive bids about Sept. 1 for the construction of a power generating plant including two turbines, four boilers, stokers and switchboard, at Gardner State Hospital here. Estimated cost $125,000 to $150,000. Albert B. Franklin, Inc., 25 Haverhill St., Boston, is engineer.

Mass., Plymouth—LeBaron R. Barker, plans the construction of a waterworks pumping plant and two flumes at north short of White Island. Estmated cost to exceed $40,000. Private plans.

Mass., Provincetown—Northern Gas Utilities Co., Inc., 15 Congress St., Boston, plans the construction of a gas plant here. Estimated cost $70,000. G. H. Stevens, 141 Milk St., Boston, is architect.

Mass., Squantum—State awarded contract for the construction of a sewage pumping station to A. D. Daddario, 15 Agnes Ave., Hyde Park. Estimated cost to exceed $25,000.

Mass., Taunton—Commonwealth of Massachusetts, Dept. of Mental Diseases, is having preliminary plans prepared for improvements to boiler room including two 250 hp. water tube boilers and stack at State Hospital. Estimated cost $45,000. C. T. Main, Inc., 201 Devonshire St., Boston, is engineer.

Mo., St. Louis—St. Louis University, awarded contract for the construction of a 14-story hospital, including power house, laundry, etc., at Grand Blvd. and Vista Ave., to Hercules Contracting Co., Wainwright Bldg. Estimated cost $1,850,000.

Mo., Sullivan—City plans an election Sept. 1 for the construction of a light and power plant and distribution system. Estimated cost $80,000. W. A. Fuller Co., 2916 Shenandoah Ave., St. Louis, is engineer.

Neb., Omaha — Douglas County, G. Berger, Clk., awarded contract for the construction of a power house for new county hospital, to R. Butke, Omaha. $32,000.

N. J., Hackensack—Board of Chosen Freeholders, O. M. Hurd, Chn., Court House, awarded contract for the construction of a central heating plant on Hudson St. to Potterton Bros., Main St., Closter. $58,800.

N. Y., Albany—Albany Port District Commission c/o P. G. Ten Eyck, Chn., will receive bids in Sept. for the construction of a grain elevator, 2,000,000 bu. capacity. Estimated cost $1,500,000. MacDonald Spencer Engineering Co., 420 Lexington Ave., New York, is engineer.

N. Y., Eltingville (sta. Staten Island)—New York & Richmond Gas Co., 691 Bay St., St. George, abandoned plans for 1 story illuminating gas plant at Sycamore St. and Richmond Ave., here. Estimated cost $40,000. Private plans. Building permit denied.

N. Y., New York—Consolidated Gas Co., Irving Pl., had plans prepared for the construction of a gas exhaust house and conveyor at Hunts Point Ave. and Bronx River. Estimated cost $45,000. Private plans.

O., Cleveland — Hughes Provision Co., W. Hughes, Pres., 3199 West 65th St., awarded contract for a 47 x 63 ft. boiler house to Arthur Thomas, 2431 East 83rd St. Estimated cost $40,000.

O., Cleveland—Syndicate c/o Chapman Construction Co., Standard Bank Bldg., Contrs., will build a 1 story, 210 x 400 ft. boiler house and greenhouse on North Elmstead St. Estimated cost $50,000.

R. I., Howard — Dept. of Public Welfare, State House, Providence, will soon award contract for the construction of a 3 story, 70 x 385 ft. reformatory, including ice plant here. Estimated cost $500,000. T. H. Murphy, Jr., Howard, is architect.

Tex., Corpus Christi—Central Power & Light Co., Alamo National Bank Bldg., San Antonio, awarded contract for a 60 x 110 ft. plant and office at Corpus Christi to Wood Sherman Construction Co., Corpus Christi. $45,000.

Tex., Giddings—City c/o J. S. Hillsman, Mayor, will soon award contract for the construction of a complete sewage disposal plant including pumping station, mains, etc. J. Rady, Waco, is engineer.

Tex., San Augustine—Texas Pipe Line Co., Texas Co. Bldg., Houston, plans to rebuild pumping plant on oil line here, recently destroyed by fire. O. Wolk, Houston and San Augustine, is engineer.

B. C., Vernon—Inland Ice & Cold Storage Co. Ltd., awarded contract for the construction of a 4 story, 100 x 100 ft. cold storage warehouse for fruit to Dominion Construction Co. Ltd., 509 Richards St., Vancouver. $40,000; refrigeration equipment, to T. M. Grindley Co. Ltd., 1641 West Second Ave., Vancouver. $14,000.

Ont., Goderich—Huron County Fruit Growers Association, G. Laithwaite, Pres., plans the construction of a cold storage warehouse. Estimated cost $100,000. E. H. Darling, 36 James St. S., Hamilton, is engineer. Wants prices and information on complete equipment.

Ont., Port Stanley — Council plans the installation of sanitary sewage system including two pumping stations. Estimated cost $85,000. F. A. Dallyn, 71 King St. W., Toronto, is engineer.

Ont., Strathroy — Middlesex Fruit Growers Association, A. McDougall, Pres., awarded contract for a 3 story, 55 x 130 ft. cold storage warehouse to James Vance, 15 Market Sq., Woodstock. $37,000.

Ont., Thessalon—City, John O. Coulter, Clk., will soon receive bids for addition to hydro-electric plant. Estimated cost $22,000.

Brazil—Central do Brazil R.R., and Federal Government, Rio de Janeiro, are having plans prepared for electrification of railroad in State of Sao Paulo.

Equipment Wanted

Boiler, Water Heater, Pumps, etc. — Comstock, N. Y.—Dept. of Correction, State Office Bldg., Albany, will receive bids until Sept. 15 for new boiler, feed water heater, feed water pumps, etc., at Great Meadow Prison here.

Boilers, Stokers, Generating Unit, etc.—Minot, N. D.—E. G. Exec. Secy. of State Bd. of Administration, State Teachers College, will receive bids until Sept. 8 for return tubular boilers, stokers, generating unit, deep well pumping unit, vacuum pump, switchboard nad soot blowers.

Pumping Equipment, Etc.—Peru, Ind.—Common Council, H. E. Worl, Clk., will receive bids until Sept. 8 for pumping and filter equipment for municipal water plant.

Pump, Etc.—Lexington, Mich.—City plans to purchase an electrically driven pump for proposed waterworks system. Estimated cost $28,000.

Pumps, etc.—Everton, Mo.—City plans to purchase deep well pump, etc., for proposed waterworks improvements. Estimated cost $20,000.

Pumps—Ely, Minn.—City will receive bids until Sept. 10 for three horizontal centrifugal motor driven pumps, etc., for proposed waterworks. Estimated cost $200,000.

Industrial Projects

Ala., Mobile—Coastal Petroleum Co. is having preliminary estimates made for the construction of a refinery plant and equipment in vicinity of Mobile. Estimated cost $200,000. Engineer not announced.

Calif., Anaheim—Schofield Automotive Engineering Inc., plans the construction of a 2 story factory. Estimated cost $40,000. A. Curlett, Union Bank Bldg., Los Angeles, is architect.

Calif., Bay Point—Congoleum-Nairn Inc., 195 Belgrove Dr., Kearny, N. J., is having preliminary plans prepared for the construction of a factory for the manufacture of linoleum, felt base floor covering, etc., here. Estimated cost $1,500,000. Sanderson & Porter, 1 Montgomery St., San Francisco, are engineers.

Calif., South San Francisco — Pacific Bone Coal & Fertilizer Co., Financial Center Bldg., San Francisco, awarded contract for addition to plant here to Austin & Co., Russ Bldg., San Francisco. $100,000.

Ga., Rossville—Peerless Woolen Mills, will soon award contract for a 3 story, 100 x 300 ft. addition to plant. Estimated cost to exceed $250,000.

Mass., Attleboro—L. G. Balfour Co., 27 County St., awarded contract for the construction of a 3 story factory and power plant, Sect. 1 to H. F. Lull, Main St., Pawtucket, R. I. and Sect. 2 to H. O. Maskinnon & Co., 38 Emory St., Attleboro. Estimated cost $200,000.

N. J., Bayonne—Tidewater Oil Co., Constable Hook, awarded contract for the construction of an oil refinery plant including cracking equipment to Walter E. Lumis Co., 30 Church St., New York. Estimated cost $200,000.

N. J., Newark—Emile Snyder, Inc., 306 South St., plans to rebuild a 2 story refinery plant at 298-306 South St. Estimated cost $40,000.

Tenn., Chattanooga—Davenport Hosiery Mills, 906 Georgia Ave., will soon award contract for addition to hosiery mill to include dyeing plant, boiler house, etc. Estimated cost to exceed $100,000. Roberts & Co., Bona Allen Bldg., Atlanta, Ga., are architects and engineers.

Tex., Harlingen — Solid Carbonic Corp., Harlingen, will soon award contract for the construction of a dry ice plant. Estimated cost $70,000. Private plans.

Tex., Port Neches—Carolina Cotton Mills, subsidiary of L. Banks Holt Mfg. Co., Graham, N. C., plans the construction of a cotton mill here. Estimated exceed $100,000.